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ADMIRAL SIR VESEY HAMILTON, K.C.B., in the Chair.

THE RAM, IN ACTION AND IN ACCIDENT.

By W. LAIRD CLOWES, United States Naval Institute, Fellow of King's College, London.

I HAVE heard naval officers, of all ranks from the lowest to the highest, and in this theatre as well as elsewhere, express themselves in very sanguine tones concerning the future of the ram in naval warfare. I do not by any means intend to imply that all naval officers appear to believe to the same extent in the efficacy of this weapon. But I have known many, and among them officers of great experience at sea, who by their utterances suggest that, given slight superiority of speed and good handling, one ship can, without much difficulty, be made to ram another, even when the other is under full control and has plenty of sea-room in which to manœuvre. This view of the capabilities of the ram has always, though in a loose and vague kind of way, been widely held; and I venture to think that the number of those who hold it has increased of late, and especially since last June, when the country had to lament the terrible and dramatic fate of the "Victoria," and of so many of her gallant officers and men.

It would be undue presumption on my part to evolve, as it were, from my inner consciousness, any opinions and theories as to the employment of the ram, and to put them forward here, before a meeting composed almost entirely of naval officers and practical men, as views worthy of serious consideration. But, recollecting as I do that naval officers and practical men have but little leisure for the study of the past, and that, nevertheless, they all agree that the teachings of the

past are of the utmost value to them, I am encouraged to lay before them a number of facts which I have assembled, and, with all deference, to indicate certain conclusions which those facts seem to force upon the mind of a very devoted, and I trust wholly unprejudiced, student of recent, as well as of ancient, naval history. I do not, in a word, ask you to listen to me, but to pay attention to the voice of events, which, though by-gone, have not ceased to be instructive.

The following is a detailed list of 74 cases of attempted ramming in what may be called modern naval warfare. I have included here all the cases, since the outbreak of the American War of Secession, on which I have been able to lay my hand. The list must not, therefore, be regarded as a list of selected examples. No doubt I have omitted some cases, but I have intentionally omitted none.

In the first column I have numbered the cases to facilitate future reference. In the second I have given the date. In the third I have specified whether the scene of the occurrence was in narrow waters (N.) where manœuvring was difficult if not impossible, or in some locality (S.) which afforded a reasonable amount of sea-room. In the fourth column is the name of the would-be rammer. In the fifth is the name of the craft which it was endeavoured to ram. In the sixth column I have shown the condition of the would-be rammer after the manœuvre had been executed or had failed. By U. I mean that the ship was, so far as the operation was concerned, uninjured; by Da., that she received slight or moderate damage; by S.Da., that she received serious damage sufficient to greatly impair her immediate fighting powers; by R.A., that she missed her mark and ran ashore; and by S., that she sank in consequence of the collision. In the seventh column I have indicated whether the ship intended to be rammed was at the moment under steam (S.), at anchor (A.), or unmanageable, on account of accident either to her machinery or to her steering gear (Un.). In the eighth and last column I have noted the condition, in consequence of the attempt, of the vessel intended to be rammed; U. signifying uninjured; Da., slight or moderate damage; S.Da., serious damage; Di., disabled; and S., sunk.

Particulars of Attempts to Ram in Action, 1861—1879.

1.	2. Date.	3. Nature of locality.	4. Rammer.	5. Rammell.	6. Subsequent condition of rammer.	7. Previous situation of rammed.	8. Subsequent condition of rammed.
1	Oct. 11, 1861	N.	Manassas	Richmond	S. Da.	A.	Da.
2	Feb. 10, 1862	N.	Commodore Perry	Sea Bird	U.	A.	S.
3	Mar. 8, 1862	S.	Virginia	Cumberland	Da.	A.	S.
4	Mar. 9, 1862	S.	Monitor	Virginia	U.	S.	U.
5	Mar. 9, 1862	S.	Virginia	Monitor	Da.	S.	U.
6	Apr. 24, 1862	N.	Manassas	Pensacola	U.	S.	S. Da.
7	Apr. 24, 1862	N.	Manassas	Mississippi	U.	S.	S. Da.
8	Apr. 24, 1862	N.	Manassas	Brooklyn	U.	S.	S. Da.
9	Apr. 24, 1862	N.	Governor Moore	Varuna	U.	S.	S.
10	Apr. 24, 1862	N.	Stonewall Jackson	Varuna	U.	S.	S. Da.
11	May 10, 1862	N.	General Bragg	Cincinnati	U.	S.	S.
12	May 10, 1862	N.	General Price	Cincinnati	U.	S.	S.
13	May 10, 1862	N.	General van Dorn	Mound City	U.	S.	Di.
14	June 6, 1862	N.	Queen of the West	Lovell	U.	S.	S.
15	June 6, 1862	N.	Beauregard	Queen of the West	U.	Di.	Di.
16	June 6, 1862	N.	Beauregard	Monarch	U.	U.	U.
17	June 6, 1862	N.	Price	Monarch	U.	S.	U.
18	June 6, 1862	N.	Monarch	Beauregard	U.	S.	S.
19	July 18, 1862	N.	Arkansas	Carondelet	U.	S.	U.
20	July 22, 1862	N.	Essex	Arkansas	U.	S.	Da.
21	July 22, 1862	N.	Queen of the West	Arkansas	Da.	A.	Da.
22	Jan. 1, 1863	N.	Harriet Lane	Bayou City	Da.	S.	Da.
23	Jan. 1, 1863	N.	Neptune	Harriet Lane	S.	S.	Da.
24	Jan. 1, 1863	N.	Bayou City	Harriet Lane	Da.	S.	Da.
25	Jan. 31, 1863	S.	Keystone State	Palmetto State	Da.	S.	U.
26	Feb. 24, 1863	N.	Queen of the West	Indianola	U.	S.	Da.

Particulars of Attempts to Ram in Action, 1861—1879—continued.

1.	2. Date.	3. Nature of locality.	4. Rammer.	5. Rammed.	6. Subsequent condition of rammer.	7. Previous situation of rammed.	8. Subsequent condition of rammed.
27	Feb. 24, 1863	N.	Webb	Indianola	Da.	S.	U.
28	Feb. 24, 1863	N.	Webb	Indianola	U.	S.	Da.
29	Feb. 24, 1863	N.	Queen of the West	Indianola	U.	S.	U.
30	Feb. 24, 1863	N.	Queen of the West	Indianola	U.	S.	Da.
31	Feb. 24, 1863	N.	Queen of the West	Indianola	U.	S.	S.
32	Feb. 24, 1863	N.	Webb	Indianola	U.	S.	S.
33	Oct. 7, 1863	N.	Wachusett	Florida	U.	A.	Da.
34	Nov. 9, 1863	S.	Nippon	Ella and Anne	Da.	S.	Da.
35	Apr. 18, 1864	N.	Albemarle	Miami	U.	S.	Da.
36	Apr. 18, 1864	N.	Albemarle	Southfield	U.	S.	S.
37	Apr. 18, 1864	N.	Albemarle	Miami	U.	S.	U.
38	May 5, 1864	N.	Sassacus	Albemarle	S.Da.	S.	Da.
39	May 5, 1864	N.	Albemarle	Matabosett	U.	S.	U.
40	Aug. 5, 1864	S.	Tennessee	Hartford	U.	S.	U.
41	Aug. 5, 1864	S.	Monongahela	Tennessee	U.	S.	U.
42	Aug. 5, 1864	S.	Ossipee	Tennessee	U.	S.	U.
43	Aug. 5, 1864	S.	Monongahela	Tennessee	Da.	S.	Da.
44	Aug. 5, 1864	S.	Lackawanna	Tennessee	Da.	S.	Da.
45	Aug. 5, 1864	S.	Hartford	Tennessee	U.	S.	U.
46	June 11, 1865	N.	Amazonas	Jeguy	U.	S.	S.
47	June 11, 1865	N.	Amazonas	Salto	Da.	S.	S.
48	June 11, 1865	N.	Amazonas	Marquez de Olinda	Da.	S.	S.
49	July 20, 1866	S.	Erz. Ferdinand Max	Re d'Italia	U.	S.	U.
50	July 20, 1866	S.	Erz. Ferdinand Max	Palastro	U.	S.	Da.
51	July 20, 1866	S.	Erz. Ferdinand Max	Re d'Italia	U.	Un.	S.
52	July 20, 1866	S.	Ancona	Erz. Ferdinand Max	U.	U.	U.
53	July 20, 1866	S.	Kaiser	Re di Portogallo	S.Da.	S.	S.Da.
54	July 20, 1866	S.	Affondatore	Kaiser	U.	S.	U.

Particulars of Attempts to Ram in Action, 1861—1879—continued.

1.	2. Date.	3. Nature of locality.	4. Rammer.	5. Rammed.	6. Subsequent condition of rammer.	7. Previous situation of rammed.	8. Subsequent condition of rammed.
55	July 20, 1866	S.	Re di Portogallo	Schwarzenberg	U.	S.	U.
56	July 20, 1866	S.	Maria Pia	Areadion	U.	S.	U.
57	Aug. 18, 1867	S.	Izzedin	Meteor	U.	Un.	S.Da.
58	Nov. 9, 1869	S.	Bouvet	Shah	U.	S.	Da.
59	May 29, 1877	S.	Huascar	Emeralda	U.	S.	U.
60	May 21, 1879	S.	Huascar	Emeralda	U.	S.	U.
61	May 21, 1879	S.	Huascar	Emeralda	U.	S.	U.
62	May 21, 1879	S.	Huascar	Emeralda	Da.	Un.	S.
63	May 21, 1879	S.	Independencia	Covadonga	U.	S.	U.
64	May 21, 1879	S.	Independencia	Covadonga	U.	S.	U.
65	May 21, 1879	S.	Independencia	Covadonga	R.A.	S.	U.
66	May 21, 1879	S.	Independencia	Covadonga	U.	S.	U.
67	July 10, 1879	S.	Huascar	Magellanes	U.	S.	U.
68	July 10, 1879	S.	Huascar	Magellanes	U.	S.	U.
69	July 10, 1879	S.	Huascar	Magellanes	U.	S.	U.
70	Oct. 8, 1879	S.	Huascar	Cochrane	U.	S.	U.
71	Oct. 8, 1879	S.	Cochrane	Huascar	U.	S.	U.
72	Oct. 8, 1879	S.	Cochrane	Huascar	U.	S.	U.
73	Oct. 8, 1879	S.	Huascar	Blanco Encalada	U.	S.	U.
74	Oct. 8, 1879	S.	Cochrane	Huascar	U.	Un.	U.

Before summarizing the results, I will add a few notes on some of these cases.

3. The "Virginia" in this case wrenched off her ram, and so decreased her efficiency for the action of the following day.
- 4, 5. The "Virginia" had a speed of about 5 knots only on this day. The "Monitor" was little faster.
15. The "Queen of the West" was run ashore to avoid sinking.
20. The "Essex" was very slow. The "Arkansas," though fast by the stern, had cast off by the bows, and was able to swing her head round to meet the attack.
24. The "Bayou City" was able to board and capture the "Harriet Lane."
25. There is some doubt as to whether the "Keystone State's" opponent was the "Palmetto State" or the "Chicora." The "Keystone State," on approaching, was damaged and practically turned off by shell-fire.
26. The "Indianola" had a barge lashed on her port side. This was torn away and sunk.
27. The "Webb" and "Indianola" rammed one another bows on. The former damaged the ram.
28. The "Indianola" had a barge lashed on her starboard side. This was crushed and sunk.
- 31, 32. These were practically simultaneous, the "Queen of the West" ramming on the starboard side, and the "Webb" astern.
33. This occurred off Bahia in neutral waters. The "Florida," struck on the starboard quarter, had her bulwarks cut down and her main and mizen yards carried away, but was not actually disabled, although she surrendered.
34. The "Nippon," and the "Ella and Anne," a blockade-runner, rammed one another bows on. The latter lost her bowsprit and stem, and was boarded and taken.
- 35, 36, 37. The "Miami" and "Southfield" were lashed together, the former on the starboard side of the latter. In No. 35 the "Miami" was struck on the port bow. In No. 36 the "Southfield" was struck fair on the starboard bow, and tearing away, sank. In No. 37 the "Miami," being free, escaped.
38. The "Sassacus," which was not adapted for ramming, struck squarely and at some speed just abaft the beam, but did more harm to herself than to her enemy.
43. The "Monongahela" lost her ram.
50. The "Palestro" lost her mizen topmast and gaff with ensign.
51. The Austrian official report says: "In the meantime it looked as if the 'Re d'Italia's' helm had been shot away, for from this moment she lay isolated in the midst of several of the Imperial ironclads. . . . Rear-Admiral von Tegetthoff did not fail to note the critical situation of the 'Re d'Italia,' whose movements, owing to the injury to her steering gear,

were confined to backward and forward ones The 'Re d'Italia' went ahead at full speed in order, if possible, to avoid the blow, or to weaken the force of it: but an Austrian ironclad barred her way. Then she went full speed astern." This shows I think, beyond question, that at the time of receiving the blow which immediately followed, she was not under control. The blow upset everyone who was below in the "Erzherzog Ferdinand Max." The ram penetrated 6 ft. 6 in., the flag-ship having on her a speed of 11.5 knots. The "Re d'Italia," which was struck on the port side, rolled 25° to starboard, then more heavily to port, and sank almost immediately in 200 fathoms.

53. The "Kaiser" was a wooden line-of-battle-ship; the "Re di Portogallo," an ironclad. The former, going at full speed, struck a slightly glancing blow on the beam. She lost her bowsprit, stem, foremast, and funnel, and was seriously hurt. The ironclad was also badly injured.
56. The "Maria Pia's" opponent, which she failed to strike, was an Austrian wooden ship.
57. Both vessels were iron paddle-steamers, the "Izzedin" having a speed of 15.5 and the "Arcadion" of 15 knots. The latter was not rammed until she had by gun-fire lost the use of one paddle. The blow so badly damaged her that she was run ashore and burnt to save her from capture.
58. The "Bouvet," capable of steaming at 11 knots, struck the "Meteor," which could do only 6 knots, a glancing blow on the port bow at an angle of 5°, and rubbing along the port side, damaged the "Meteor's" upper works, and upset two guns which had been run out ready for firing.
- 60, 61, 62. The "Huascar" on this occasion steamed at about 8 knots. According to the official American account ("Information from Abroad. War Series, No. 11") she fired at the "Esmeralda" at least 40 shots from her two 300-prs. Of these only one struck the enemy, but that one passed through the side, burst in the engine-room, and killed every one of the engineers, besides disabling the engine. The fight was the most gallant one that has ever been waged in modern naval warfare. At the first collision, Captain Prat, followed by one man, boarded from the "Esmeralda," which was nearly motionless by that time. Both were shot down on the "Huascar's" deck. At the second collision, Lieutenant Serrano, next in command, boarded and was also shot down. At the third collision, the little Chilian wooden sloop, old, rotten, unable to move, but still firing, went to the bottom with her colours flying.
65. The "Covadonga," an old gunboat, was incapable of doing 5 knots; the "Independencia," an ironclad, could do nearly 12 knots. The "Covadonga," nevertheless, avoided all three blows, and by good management so placed herself that, on the third occasion, the "Independencia," missing her, and

at the same moment losing her helmsman, went ashore, where she was burnt to save her from capture.

71, 72, 74. These attempts all failed, although the "Cochrane," at the beginning of the action, could steam 12 knots to the "Huascar's" 10. After 73, the "Huascar" became partially uncontrollable.

The following summaries of the results to would-be rammer and intended rammed in the above 74 examples are, I think, very suggestive.

The results, so far as the ships intended to be rammed are concerned, were :—

Previous situation of the ship attempted to be rammed.	Total number of cases.	Effect upon the ship attempted to be rammed.				
		Nil.	Slightly damaged.	Seriously damaged.	Disabled.	Sunk.
Under steam with sea-room	32	26	5	1	—	—
Under steam in narrow waters	32	9	9	3	2	9
Unmanageable	4	1	—	1	—	2
At anchor	6	—	4	—	—	2
	74	36	18	5	2	13

The results, so far as the ships ramming are concerned, were :—

	Effect upon the ship attempting to ram.				
	Nil.	Slightly damaged.	Seriously damaged.	Disabled (run ashore).	Sunk.
Total number of cases, 74	56	13	3	1	1

It will be observed that in 42 out of the whole number of 74 cited attempts at ramming, damage of some kind or other was done to one or both ships. In 24 of these 42 cases of effectual collision, the ramming ship received no damage worth mentioning; but in seven cases the ramming ship did herself about as much harm as she did to her opponent; and in seven other cases she injured herself even more severely than she injured her enemy. In no case did both rammer and rammed sink.

All these cases occurred, of course, before the automobile torpedo had developed into anything like a perfect weapon, and most of them before the introduction of heavy breech-loading and light quick-firing guns. But, reasoning upon the conditions which ruled up to the end of 1879—since when, I believe, there have been no cases of ramming in action—and upon the experience of the 74 attempts which I have noticed, we may fairly say that the probable results, under the old state of affairs, of 100 efforts to ram, would have been thus distributed:—

A. If both ships had sea-room and were under control:—

(Based on the 32 cases numbered 4, 5, 25, 34, 40 to 45, 49, 50, 52 to 56, 58 to 61, and 63 to 73.)

(1.) Effect on the attacked:—

Sunk	0-000
Seriously damaged	3-125
More slightly damaged	15-625
Uninjured	81-250
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	100-000

(2.) Effect on the attacker:—

Fatally injured (run ashore)	3-125
Seriously damaged	3-125
More slightly damaged	15-625
Uninjured	78-125
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	100-000

B. If both ships were in narrow waters, but under control:—

(Based on the 32 cases numbered 6 to 19, 22 to 24, 26 to 32, 35 to 39, and 46 to 48.)

(1.) Effect on the attacked:—

Sunk	28-125
Disabled	6-250
Seriously damaged	9-375
More slightly damaged	28-125
Uninjured	28-125
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	100-000

(2.) Effect on the attacker:—

Sunk	3-125
Seriously damaged	3-125
More slightly damaged	15-625
Uninjured	78-125
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	100-000

The obvious conclusions are somewhat remarkable. One is that, if two ships have sea-room and be fully under control, it is actually more dangerous to try to employ than to try to escape the ram, and that, under these conditions, it is practically hopeless to dream of ramming effectively, since there is no recorded case of the operation having been performed, although it has been attempted at least 32 times. Another is that, in such circumstances, the rammer stands about the same chance as the rammed does of sustaining non-fatal injuries. Another is that the risks attendant upon ramming are the same whether the attempt be made at sea or in narrow waters. The exact similarity of A (2) and B (2) is, indeed, extraordinary. I do not know that any of these conclusions have ever before been called attention to.

To what extent, it may be pertinent to ask, has the value of the ram as an offensive weapon been modified by the progress of the last 15 years? Will captains be more willing, or will they be less willing, to use it, now, when the nearer they approach to the foe the more fatal will be the foe's quick-firing artillery, and when, at any range up to 800 yards, the effects of a torpedo are to be feared? And why should captains attempt to employ the ram at all, when a torpedo, which is far less easy to avoid, and the use of which involves little or no risk to the user, will do all that is necessary? It may be granted that, having first disabled his enemy by gun-fire, a captain may ram with a reasonable probability of success; but, in doing so he not only risks damaging own ship, encountering torpedoes, and bringing about needless loss of life, but adopts a course that leaves comparatively little chance that the enemy, which by other action might be reduced and taken, will ever be added to the effective sea-forces of his own country. And, after all, a triumph is only half a triumph unless there be something to show for it. One of the few things that would go towards reconciling Great Britain to the agonies of a naval war would be the occasional spectacle of a foreign battle-ship brought into Spithead, or Plymouth Sound, with the white ensign blowing out above the other flag. That is a sight which would animate the whole Empire, even in its hours of misery. If only on these grounds it seems unwise to destroy your foe when peradventure you can take him alive. And it is scarcely conceivable that a disabled vessel cannot be reduced and made to strike by the combined influence of gun-fire and the threat of the torpedo.

I have cited 74 examples of the intentional employment of the ram. In those cases it has in one way or another brought about the loss of 15 ships only, including those which perished by their own act. But the ram unintentionally employed, both in action and in peace-time, has, I am afraid, been much more fatal. I am not going to trouble you with another long list and with more statistics. I will only recall the damage it has wrought in the case of the "Iron Duke" and the "Vanguard," the "König Wilhelm" and the "Grosser Kurfürst," the "Camperdown" and the "Victoria," the "Osprey" and the "Amazon," the "Ajax" and the "Devastation," and many more, in peace-time; and mention two or three examples of its dangerous

effect upon friends in action. At the battle of Memphis, on June 6, 1862, the Confederate vessels "Beauregard" and "Price" unintentionally rammed one another, and the latter had to run ashore to avoid sinking. At the Battle of Mobile, on August 5, 1864, the "Lackawanna" unintentionally rammed, and very nearly sank, her consort, the "Hartford," Admiral Farragut's flag-ship, and soon afterwards the "Ossipee" was unable to avoid ramming the "Tennessee" after the latter had surrendered. Again, on the great day of Lissa, the "Ancona" accidentally rammed her consort the "Varese," and the "San Martino" her consort the "Maria Pia." The "Ancona" and "Maria Pia" received only slight damage, but the "San Martino" had her ram twisted and sprang a leak.

To my mind, if I may intrude an opinion by way of making an end, the main lessons of the past on the subject indicate, firstly, that to endeavour to effectively ram a ship that has sea-room and that is under control is hopeless, even if she be of greatly inferior speed; secondly, that a vessel that cannot be sacrificed ought never to be deliberately employed as a ram; and, thirdly, that for ramming purposes a little ship is quite as good as a big one. Whether or not this last deduction points to the fact that, with a view to certain eventualities, this country would do well to build a few fast small craft intended for ramming only, and of no particular value, I will not presume to say. But upon that point I am specially desirous to learn the views of those who are competent to speak about it.

Vice-Admiral NICHOLSON: Mr. Chairman, I venture to make a few remarks on the most interesting paper that has just been read to us. We must all have been surprised at the result of the figures which have been brought out by Mr. Laird Clowes. No doubt the lesson will be most instructive; but I think there are some very important matters to be discussed in connection with the question of ramming, and I hope to hear the opinions of those who are better fitted to express them than myself. It appears to me that whether the ram is a very efficient weapon or not is outside the question. Our lecturer says "naval officers" are very hopeful about it in action. It is not, however, only the naval officers who are very hopeful, but also the rulers of the Navy and naval constructors, because we see every ship of any structural strength is fitted with one of these rams, and evidently they would not have been so fitted if they had not been intended to be used. Therefore, we, as naval officers, have to consider this question. Having these rams given us as a means of offence, and consequently being bound to develop their legitimate use, as well as that of torpedoes and guns, what relative value should we attach to them? The question is, having a very powerful ship provided with different means of offence, are we, in the first place, to avail ourselves of the ram, the torpedo, or gun? Of course there can be no question whatever that the ram must be looked upon as the last resource. I do not think anyone would be so mad as to attempt to use his ram early in action, and I doubt very much whether in a single action, in spite of all that has been said in this theatre on the subject, the ram would ever be efficiently used, except to deliver the *coup de grace*. But there are other conditions in which a ram might be used with great effect. Take the case of a general action; to use sporting *parlance*, one or two rounds having been fought out, everybody knows the confusion which would ensue. At Lissa there were seven intentional attempts to ram and a very large number of unintentional collisions. Suddenly an enemy's ship shoots out from amidst the thick smoke, and is crossing your bow with her whole broadside bearing on you. There is now only one thing that can be done; you cannot stop, you cannot go astern, and you had better harden your heart and use the ram. I think it is under such con-

ditions of confused action that, probably, the ram will develop its greatest use—I mean during the sudden and unforeseen emergencies of a general action. The perfection of the torpedo is so great, and the gun fire so terrific, that, beyond these accidental occasions, I do not think ram power would be a very efficient or powerful quality to possess, and certainly it would be a hazardous one to use. The point that I wish, then, with all modesty, to press upon my brother officers is this: Whether in the light of what has happened of late years they are content with the construction of the rams of our ships. We all know the lamentable instance of the loss of the “Victoria.” What happened? The ships were not going at a great speed, but the “Camperdown” only escaped by the skin of her teeth. Then, shortly afterwards, a 2nd class cruiser, the “Forth,” a ship of 4,000 tons, coming up channel on a foggy day, presumably not at an excessive speed, accidentally collides with an empty collier. What would naval officers imagine should be the result of such a collision? Surely that the 2nd class cruiser of 4,000 tons would have gone through the empty collier like a knife through a pat of butter! But what happened? The “Forth” had to go into Plymouth with her bows very seriously damaged. Surely there must be something wrong! And the three points I wish to suggest to the meeting are these: 1st. Whether it is not possible that the rams of ships should be constructed of such material and with such skill that they should be capable of sustaining one of these heavy blows given in actual warfare without material damage? 2ndly, if this is not possible, would it not be wiser that the rams should be fitted not as a part of the main construction of the ship, so that if you come into collision, and your ram unfortunately is broken, still the main structure shall remain intact? And the third point I would raise is this: If it is considered desirable that these precautions should be taken in ships that are to be constructed, is it not as desirable that the whole question should be most seriously considered, and, if possible, the rams of ships already built should be strengthened, so that officers, when they feel bound to use this weapon, shall not at the same time fear that they are incurring the risk of sacrificing the ships which the country has placed in their charge?

Lieutenant W. BADEN POWELL: I should like to make one remark with regard to what Admiral Nicholson has put before the meeting, “that the ram, when it has done its work, if damaged, might drop off free of the ship.” I think there would be a very grave danger to the ship with regard to that ram if it did not drop off, because if there was any angle on the blow in striking the other ship, the ram might get knocked to port or starboard, and though it might do its own work it would leave that ship with practically a bow rudder hard over, and she would do nothing but circle after that until she had been got into dry dock. So that, I think, the only way to look at the ram after the experience of the loss of the “Victoria,” and the damage to the “Camperdown,” is to see that it is sufficiently well constructed not to part from the ship, not to twist, and not to damage the ship on impact with the vessel she is intended to ram. I have had, since I have been on shore, very considerable experience in the Admiralty Court of what we may hope is unintentional ramming. The whole of the work in which I have been engaged has been collisions, and we have hundreds of collisions every year, in which merchant ships and some men-of-war unfortunately touch other ships, and with their stems. In nearly every case those mercantile ships are not constructed in any way with the intention of ramming, but they are all constructed with the anticipation of some day perhaps hitting a dock wall or a ship, and thereby damaging themselves to such an extent that they may be in danger of sinking. They are one and all now constructed with most efficient watertight bulkheads, forming a collision compartment, and I may say, without exaggeration, that every year produces hundreds of ships—Lloyd’s would be able to give the exact statistics— which after serious ramming are able to get to port, even hundreds of miles, though their bows are completely crushed out of all shape, simply by virtue of that strong collision bulkhead, which prevents the water from getting any further into the ship. I can only say, with due deference to the gentlemen who at the Admiralty and in ship-yards design vessels, that I think it is not “quite up to date” that Her Majesty’s ships, like the “Camperdown,” should

suffer so enormously from what I call a very mild impact with the "Victoria." If the "Camperdown" had been going at full speed and had struck the broadside of the "Victoria" crossing at full speed, would not the damage have extended a great deal further aft, on one bow or perhaps both; and is it not also especially likely that the "Camperdown" would have been lost at the same time as the "Victoria"? I think when there is any settled intention of using the ram it should be the naval architect's first principle to see that the structure of the bow of the ship, either by bulkheads and stringers, or by a kind of side longitudinal strengthening outside of the ship, in the nature of ridges, should be so strong that nothing on earth or on the water should turn or twist that ram, or do damage to the bow affecting the safety of the ship. I think until this principle has been thoroughly well introduced into the construction of the ships of the Service, captains will, as has been said by the lecturer and by Admiral Nicholson, use the ram as simply the last chance; so that I think it is purely a question of ship construction for the future as to whether the ram is to be relied upon—indeed if it is to be used at all.¹

Captain CURTIS: I should like to say a word or two upon what Lieutenant Baden Powell has said. In the Crimean War the "Recruit" went from Malta to Corfu with a double rudder, a rudder at each end, but the rudder was not locked at the bows, apparently it never turned the ship from her course, as it was not discovered until they anchored at Corfu.² I think that proves that the bow rudder would have very little effect on the vessel going ahead. I have always understood that the greater the velocity with which you strike a body the better it is for the striking body. You remember the old experiment of firing a candle through a barn door, and we all see in railway collisions that when a train is going at a tremendous speed it suffers less than if it is going at a small speed. I have no doubt there are gentlemen here who have been to school later than myself, and they know all about the theory of forces.

Admiral BOYS: It seems that our young members are somewhat bashful in giving us their views on this important subject. Therefore, although I am an old one, I rise to say a word or two. With respect to the "Camperdown." I happen to know something about the "Camperdown," having had a son in her at the time of the collision, and we have corresponded on the subject. It is generally thought that the "Camperdown" was in great danger of following the "Victoria" to the bottom from the effect of the collision, and so she was. But it was not from the damage done to her own ram; that was uninjured, the damage was all above the ram, and it was because the watertight doors were not closed that the ship was in danger. If the watertight doors had been closed in time, as they would have been "in action," there would have been comparatively but little risk in the "Camperdown," beyond the filling of the foremost compartments. With regard to the removable ram that has been referred to, I do not think such an arrangement practicable, it would never stand a collision, and would weaken a ship where she should be strongest.

The CHAIRMAN (Admiral Sir R. Vesey Hamilton): I think with regard to what Admiral Nicholson said, we have an every day illustration of it in every regatta, that is, the galley and punt race. The difficulty of the galley catching the

¹ Generally the discussion appears to treat the matter as a question as merely a dual action between two ships; but the ram and the bow construction, fit to rely upon, must be capable of repeating the ramming dose to other ships of the enemy. With the nearest dry dock perhaps six or more days distant, the bow construction must be above suspicion, otherwise the ram will never be used, at least while a shot remains in the locker. In such case the ram bow, which is the worst form of bow for meeting a head sea at speed, may well be given up altogether.

² Relative to the "Recruit," I receive the information from the navigating officer. In the year 1861 the late Mr. Laird, of Birkenhead, was of opinion the bean-cod bow or stem, such as the Lisbon boats have, was the best form for a ram-bow. He fitted the Birkenhead ferry boats with such stems, and he remarked that nothing can come near the upper works. What is required is to crush the side in, not to pierce a hole and get jammed in the ribs of the ship.—J. D. C.

punt is very great, in fact it is almost an impossibility if the punt is properly handled. Therefore the short ship has a very great advantage. The fact that the ram of a big ship like the "Forth" should be wrenched off by a little collier shows something very radically wrong in the construction of rams of the present day. I myself have always thought so, and I believe that we cannot have a better ram than a straight up and down stem, which is quite sufficient for all practical purposes. There is very little fear of any damage being done to the ramming ship under such conditions. I entirely agree with what Mr. Baden Powell said, especially as to the watertight doors and the collision bulkheads, and no better instance is within my own recollection than the case of the "Arizona," which, when going 15 knots, ran into an iceberg, and backed off perfectly uninjured abaft the collision bulkhead. Had she been going at 8 knots instead of 15, she would have been racked. In this case, as in gunnery, the element of time is a consideration, even if it is only the fractional part of a second, and the "Arizona" was saved by her great speed. The moral is, if ever you are ramming another ship go at full speed, the greatest speed you can put on. Although of course I have heard of the candle and the barn door, I have never come across anybody yet who has tried it.

Captain CURTIS: I tried it last summer.

The CHAIRMAN: One has very often heard of it, but you are the first person that I have ever come across who has actually seen it tried. In that case it is precisely the same thing as the "Arizona." It is the great speed that carries it through, but if you took up a candle and dashed it on the table, it would simply go to smithereens. The result of the table drawn up by Mr. Clowes we must all agree is very curious, and has opened our eyes a great deal. There is one illustration as to the "Albemarle," which was uninjured. Some years ago I read a paper in this Institution on the result of the American Civil War. There was this very curious fact. The "Albemarle" was an improvised ram, armed with two guns. She was attacked by eight wooden vessels, which were especially ordered to ram her, and to try to run her down. The "Albemarle" had one gun disabled in the early part of the day, and she fought the whole action with one gun, and although she was repeatedly rammed by eight vessels, and they tried to circle nets round her to foul her screw, she yet gained a glorious victory, and went back without losing a man. What the Northern loss was I do not know, but Boynton, the historian, says, "many killed, wounded, and scalded." The conclusion the lecturer comes to is, that if two ships do ram it is certainly more dangerous to be the rammer than those rammed. In my own opinion he would be a very bold man who would try to ram a ship unless he was perfectly certain that her torpedoes were all fired. It is one great value of the torpedo that it acts as an anti-rammer. None of us would like to go near a ship that has a torpedo, because before you get within ramming distance you might be blown up. This is a great comfort to those who have to fight in ships, and though I shall not have to do it, it will no doubt be a comfort to those who may. Then of course there is the question as to whether we should not try to capture the enemy rather than sink her. I believe there would be nothing that would stir up the martial feeling of this country more than the sight of a captured enemy, for although we may be a nation of shopkeepers, still there is a good deal of fight in us when occasion arises.

Mr. ARNOLD FORSTER, M.P.: I should like to be allowed to say one or two words on this matter, as it does not appear that at this stage of the discussion I should be standing in the way of any naval officer. I have read the figures of the lecturer, and I confess I am not quite clear as to what are the conclusions arrived at as to whether it is safe or unsafe to ram. Mr. Clowes concludes the paper with a recommendation in which I should most respectfully concur, that ramming to be an efficient operation of war should be confined, as far as possible, to specially designed ships. But I am not convinced by his figures that the conclusion is unfavourable to the ram, because I observe in the table he gives that in as many as 70 per cent. of the cases of ramming ships within confined waters, the rammed ship has been more or less seriously damaged. Of course I am familiar with many of the cases cited, though not with all, and a great number are cases of wooden ships; and, certainly from the information I have received, I am convinced that

the problem of a wooden ship being rammed is a totally different one from that presented by the case of an iron ship when she is rammed. The question as to which ship is going to be damaged is much more difficult when you come to look into than it appears on the surface. I have lately been trying to get the opinion of scientific mathematicians as to what ought mathematically to be the result of one heavy ship ramming another at full speed. I have propounded the problem, and have never yet had an absolute definite reply as to what the answer ought to be. Of course the question is complicated, as I was told the other day, by facts which only a practised shipbuilder can supply, as to the question of the resistance offered by the particular class of materials which are opposed to the impact of the ram. If you are dealing with two solid bodies, you can work out the thing mathematically without reference to any other formula at all, and can get a positive conclusion. But certainly as far as my researches have gone into cases of modern ramming, under conditions anything like those which may probably occur in war, the record against the ram is not so serious as the lecturer would have us suppose. I remember seeing a photograph of the bow of the "Arizona," and certainly nothing could be a more perfect illustration of what might happen to a ram of a ship than that was. I do not suppose you can imagine a more immobile body than an iceberg. The "Arizona" charged the iceberg at 15 knots. The bow was smashed in, and the mild steel plates drawn and damaged, but still that ship went 700 miles and was docked, I believe, at Halifax. She was certainly not incapable of steaming or, I suppose, of taking part in an action if she had been a man-of-war. I also saw the "Northampton" after she had been rammed in the Channel by a sailing barque. The sailing barque went off scot free. I saw the side of the "Northampton," and you could drive a cart through it; at any rate, the rent was high enough for that. The blow was arrested by the armour-plating; the scroll work on the figure-head of the barque came right on board of the "Northampton." In the case of ships which have been sunk like the "Grosser Kurfürst" and the "Vanguard," the same lesson is taught. These were most marked cases of one ship ramming another with no damage, or practically none, to the ramming ship. Then there is the case of the "Bellerophon," by the mere touch of the ram, sinking a steamer off the North American coast. Of course the case of the "Forth" may be quoted as an example on the other side. What I believe was the case was this: the "Forth" is not constructed in any sense as a ram, and could not be considered to be a ram in the proper sense. As a matter of fact, she struck the steamer at the joining of two compartments—I am not sure if that is the case, but I believe so—and no doubt much damage was inflicted by the strain; but I do not know if it is considered that that solves the problem presented by a properly constructed ship adapted for the purposes of ramming. Ramming is no new thing. The war-ships of ancient times were properly constructed rams; the Roman ships, and, at a later date, the Venetian galleys, were properly provided with rams, and we have never had any reason to doubt that in those ancient actions the successful blow of the ram was absolutely fatal to the ship rammed. That was because the ram was properly constructed. The case of the "Camperdown" has been mentioned. I took some pains to follow out the contours of the ram of the "Camperdown," and I certainly can bear out the fact that the damage to the "Camperdown" was not damage done to the ram. If you followed the contours of the "Camperdown" and "Victoria," you would see structurally it was impossible that what happened could have been avoided, namely, that the "Camperdown" striking the "Victoria" should not strike her with her ram only, but, following the line of the ship underneath the stem of the "Camperdown," should come in contact with the armour-plate and the heavy deck plating of the "Victoria." The wrench was chiefly inflicted upon the upper parts of the "Camperdown," and was not in any way damage to the ram itself. A very remarkable case of ramming, on a very small scale, occurred the other day at Portsmouth Harbour, and almost at the same time I heard Sir Edward Harland speak of the particular form given to our torpedo-boats, I mean the ram-shaped bow. I believe that form has now been condemned. He said how ludicrous it is to suppose that a torpedo-boat should inflict any damage upon a seagoing ship. I do not believe myself that they were intended for that purpose; but it was curious

that only the other day the "Trafalgar" was rammed accidentally by a torpedo-boat, and that that sharp snout did go right through the thin plate of the "Trafalgar," so that the "Trafalgar" had to go into dock, and would have been actually unable to take part in an action. Certainly the result of my observation is that the ram is not necessarily a dangerous weapon to the ship which carries it. The other day I saw a photograph of the "Achilles," which was rammed in the Mediterranean accidentally, and certainly there was a sharp clean cut hole in the side of that ship which would effectually have put her out of action, but there was no corresponding danger to the ship ramming. Then we come to the question whether it is advisable for any captain to use his ram in preference to any other weapon. There of course I have a very humble opinion, but it does seem to me, and what was said by the lecturer confirms my view, that where we have great ships costing enormous sums of money, with powerful armaments and heavy armour, it would be madness for the commanding officer to attempt at the outset of an action, or at any period of an action, if his opponent were not disabled, to use his ram. And for this reason, that the use of the ram involves the fact that you are within effective torpedo range. You spend a million sterling upon a ship which can be destroyed, and if struck will most certainly be destroyed, by a torpedo the moment she comes within 600 yds. Every advantage that you give to that ship, of speed, armoury, discipline, gunnery, is neutralized in a moment if she comes within 500 yds. of a Thames tug, just as surely as if it is a ship of her own size and strength, provided that the tug successfully discharges a Whitehead torpedo. Therefore it does seem to me that no powerful ship should ever, except in the last resource, think of using the ram. But that does not remove from our consideration the question as to whether or not it would be wise to fit ships specially for the purpose of carrying rams. Certainly my opinion, guided by what I have read and heard, is very strongly to the effect that there might be a very great advantage in fitting ships on purpose to carry the ram. I am very familiar indeed with the "Polyphemus," and how she has served during her three commissions. I would not say that the "Polyphemus" is the last word in the creation of ships of her class, but I think no naval officer would hesitate for a moment to say that ships presenting a comparatively small target to gun-fire and structurally designed so as to be able to carry the ram with the greatest possible effect, having a high speed, and only taking part when their services would be likely to be effective, would not be about the most formidable engines of war that could be conceived, because, after all, granting that the ramming ship be not sunk, and even granting she is, it is absolutely the fact that a fairly delivered blow from a ram is destruction to a ship-of-war. Therefore I should support the lecturer's view in so far as he holds us to that, and I believe that the ram ought not to be discarded as a naval weapon, provided it is used by naval officers in the best and most scientific way; but I should have a great objection to any encouragement being given to use our costly vessels for the purpose of ramming, for which purposes in their present form they are not designed.

MR. E. RUPERT HICKS: With regard to the question of ramming, I certainly am of opinion, with the last speaker, that vessels should be specially constructed for that purpose, and especially that they should meet the requirements spoken of. In the case of the "Camperdown," the damage caused by the accident which happened to her bows and deck would not have occurred, in my opinion, had there been a solid steel cutting piece across the vessel's bows, to catch the second blow.

ADMIRAL BOYS: May I add one word with respect to something that has fallen from Mr. Arnold Forster, which I should not like to go forth to the public from this Institution as he has put it? I think he intimated that if a vessel was struck by a torpedo she must necessarily be destroyed. I do not agree with that at all. Having had some experimental experience with torpedoes my opinion is, it does not follow at all that a large vessel struck by a torpedo, or more than one, must necessarily be utterly destroyed.

MR. ARNOLD FORSTER: What I wished to point out was that a large ship may be destroyed by a smaller ship, and that the torpedo discharged by a small ship is equally effective as the same weapon discharged by a large ship. If I put the matter more strongly than that I admit I somewhat overstated it.

Lieut. W. C. CRUTCHLEY, R.N.R.: Sir, will you permit me to say that from the lecture, admirable though it be, there appears to be an impression that superior speed will not give you the power of ramming a slower ship? The contention has been mainly on the supposition that two vessels of unequal size are opposed to one another, but before any fair conclusion can be drawn vessels of equal size and handiness must be opposed to one another, when superior speed would give the advantage. For two vessels to run at one another end on to ram, would show as much skill in fighting as two goats in a field. The ram as a weapon would be used as a last resource, and then I think superiority of speed would be everything.

Major BLACKER: With regard to the question of the torpedo it has been stated that the fear of being struck by a torpedo will prevent a ship from ramming another. Is there any fear, on the other hand, that the torpedo might explode in the tube through a shot striking it and actually damage the ship using it? Only submerged tubes could thus be used, and they cannot always be trained in the required direction.

Commander BERKELEY, R.N.: As you have called upon junior officers, I should not like the appeal to be altogether unresponded to. There is one thing I think that has not been mentioned. I believe about the safest position in which a ship can go when she is likely to be attacked by a torpedo is full speed at her enemy. I have seen it tried some years ago on the "Polyphemus." I believe I am right in saying that she was steaming about seven knots. A torpedo was fired within three lines on her bow—I think two of them—and both glanced off within a very few feet, being turned aside by the bow wave. Therefore it seems to me the best thing we can do is to go full speed at the enemy, using our gun fire, and, if opportunity serves, our torpedo, but let us go at them with the ram by all means. The question, of course, is whether we can depend upon our weapon, and for that we must trust to the contractors and not to ourselves.

Mr. LAIRD CLOWES: When was the experiment with the "Polyphemus" that you were speaking of?

Commander BERKELEY: It was in 1886.

The CHAIRMAN (Sir Vesey Hamilton): You mean to say the torpedo did not touch the vessel at all, but the bow wave glanced it off.

Commander BERKELEY: Exactly. The torpedoes glanced off on each side.

Mr. LAIRD CLOWES, in reply, said: I am very sorry that there has not been so much discussion as I could have desired. I am afraid that it is because I have restrained myself in expressing my opinions, but I intend to express them now very definitely indeed. Admiral Nicholson made some very instructive and suggestive remarks. He spoke to the universal application of rams to battle-ships. It is an interesting fact in connection with this subject that the latest French battle-ship to be completed, the "Brennus," has no ram. She has a straight up-and-down bow. The case of the "Forth" has been cited as tending to certain conclusions. Now I purposed, when I put a title to this paper, to consider in detail the effect on the rammer and rammees of the ram in accident as well as in action, but I found that it would have taken far too long, and that I should not have been able to deal with the subject for want of time. I saw the other day at Toulon a very curious case in the action on the rammer of involuntary ramming. It was that of the French cruiser "Cécille." She has, of course, no ram, except in the sense that the "Forth" has been said to possess one. She has merely a ram-shaped bow, exaggerated into an "*avant à plage*" as the French call it. She had rammed a merchant ship and the collision had the most extraordinary effect upon her bow. The whole was twisted nearly at right angles to port, yet nothing had given way except the rivets. It was a most extraordinary piece of good workmanship; the plates were all intact, but nearly every rivet had been torn away. It is useless to cite the case of men-of-war ramming merchant ships, or of merchant ships ramming icebergs, as having any real bearing upon the question of the employment of the ram in warfare, because, as the unfortunate case of the "Camperdown" v. "Victoria" shows, a great deal of the damage which is done in such cases to the rammer is done by the knife-like action of the armoured deck of the rammees, and neither icebergs nor merchant steamers have armoured decks. As for dropping rams I do not know whether it has ever been attempted to build a

ship with a ram which could be dropped at sea without injury to the parent structure. The "Shannon" has a detachable but not a dropping ram. But in the case of the "Merrimac" that vessel did lose her ram, and she did not thereby so much weaken herself as to restrain her next day from preparing to ram the "Monitor" with her unarmoured bow. Several speakers seem to think it a question of strength and construction whether the ram should be used or not.

I will point out later what my conclusions are, but I thought that, if I had dwelt upon any conclusion at all, it was upon the fact that, whether you have a strong or a weak ram, you cannot effectually use it as long as the enemy has sea room, and is under full command. Whether the straight up-and-down stem, even if it were made so strong as to justify a ship in ramming with it, would suffer less than the sharp ram I do not know. I should think that it would not suffer any less, because, as a rule, the "tumbling-home" line of the bows of a modern ship is continued far above the water line, and therefore the tendency of it is to wrench up and lift the armoured deck of the rammed ship, and so, while intensifying the injuries of the enemy, to minimise the cutting effect of his deck. If you had a straight up-and-down bow it would not have any effect of that kind on the armoured deck, which would cut the stem nearly at right angles, and not be deflected upwards. I think that the question as to whether the ram ought to be delivered at reduced or at full speed is one which deserves a great deal of consideration. I believe in the case of the "Erzherzog Ferdinand Max" that the ship did ram at full speed, and that the speed was not actually reduced until the moment of collision. There is now rising up in the British Navy a school which would ram at full speed, although, only two or three years ago, if in this theatre the question of ramming at full speed had been put forward, nobody would have spoken in favour of it.

The importance of ramming at least at fair speed was shown in the case of the action of the "Huascar" with the "Esmeralda." The "Esmeralda" had practically no speed at all and could not run away, but the captain of the "Huascar" was anxious to save his own vessel, and he tried to ram with a speed of only 3 knots. On two occasions, although the "Esmeralda" was barely able to move, she avoided the blow, and at last, when the captain of the "Huascar" did ram, he had to ram at speed. Mr. Arnold-Forster wants my conclusions, and I shall give them. He says that he does not agree with my percentages and cites against them cases of accidental ramming. I do not think that you can lump the two classes of cases together. In the case of accidental ramming the conditions are different on the side of the rammer as well as on that of the rammees. Mr. Forster tells us that, in the case of accidental ramming, it is an unusual thing for the rammer, being a battle-ship, to do herself much harm, but we should bear in mind that in these cases of accidental ramming it generally happens that, although there is sufficient to produce damage to the rammed ship, the blow is delivered at such slight speed and in such circumstances that one would hardly expect that a specially-prepared ship should do herself any considerable damage. In action, however, attempted ramming must be at great speed or it will be almost impossible to attain any success at all. The question of superior speed has been dealt with by several speakers as something which will enable you to ram your enemy. No doubt in theory it should do so, and if one ship be running away, and the other ship, having superior speed, be coming rapidly up, you would expect the latter to be able to ram, but practice shows that it is almost impossible unless the first causes the other vessel to lose control of herself, or unless the ships be in confined waters, which comes to much the same thing. An observation made by Captain Berkeley about the "Polyphemus" reminds me that I was present in 1885, when a similar kind of experiment was tried. My recollection is that the torpedoes were not fired from any point ahead of the "Polyphemus," but from each side as she entered Berehaven. The torpedoes were deflected by her bow wave, but, of course, the operation of the bow wave on a torpedo coming at right angles to the ship would be different from that on one coming up head on; and, beyond all manner of doubt, the torpedo of the present day is very different from the torpedo of 1885. One point which I wonder has not been called attention to is this: What

is going to be the result of your ramming if you happen to have a live torpedo in your bow tube at the time? It seems to me that there again is a point that is worth consideration.

My general conclusions, so far as I can hastily formulate them, would be these:—1st. That attempted ramming is not dangerous to a rammer when there is sea room, and when the ship is under control. 2nd. That attempted ramming is always dangerous to the rammer—I mean in action—but, as a rule, only dangerous to the rammer where ships are in narrow waters or where the rammer is not under control. But, even where the rammer is not under control, ramming, besides being dangerous to the rammer, is really unnecessary, since there are generally other ways of dealing with a ship that can neither steer nor steam. She ought certainly to be made a prize.

The next conclusion would be that, since in accidental ramming the ram is notoriously dangerous, and since in cases of intentional ramming it has been shown to be not nearly so dangerous, therefore the ram (or, at least, the projecting ram) as a weapon is more dangerous to friend than foe, and might advantageously be got rid of.

My fourth conclusion would be that superiority of speed will not give success to attempted ramming. With regard to the construction of vessels specially with a view to ramming I have not intended to express any opinion. I hoped to have obtained an expression of opinion from the meeting. But it is necessary to bear in mind that vessels are built abroad especially for the purpose and for nothing else. Whether vessels like the "Katahdin," which steams at a speed of only 17 knots, will be able to do much ramming I very much doubt; but still, other Powers are building vessels for this purpose, and it is a question which we ought to consider in this country. I thank you very much for the attention which you have paid to me.

The CHAIRMAN (Sir Vesey Hamilton): I am sure you will agree in according a vote of thanks to Mr. Laird Clowes for his admirable lecture, and the great trouble he has taken in drawing up these tabulated statements with regard to the results of ramming. I do not think anyone had any idea that there were so many cases as he has tabulated.

Friday, January 26, 1894.

MAJOR-GENERAL LORD METHUEN, C.B., C.M.G., Commanding
Home District, in the Chair.

THE SOLDIER'S SORE FOOT.

By Surgeon-Captain W. C. BEEVOR, Scots Guards.

PERHAPS the most serious of the troubles encountered by those responsible for the marching power of a force of men is the condition of their feet. The history of all wars, ancient and modern, abounds in records of suffering amongst the men, and disappointment and trouble amongst their leaders, on account of the unfortunate soldiers falling out of the ranks, and in many cases utterly breaking down, from their feet becoming so painful from one cause or another that they have found it impossible to march further. In peace manoeuvres also much suffering is gone through and much loss to the fighting standard of a force is experienced from this same cause, and having had, perhaps, more than my share of experience on this, to my humble thinking, all-important subject, and having studied it in relation to the marching and fighting powers of foreign armies, I venture in all due humility to bring the results of my studies and experiences before this learned Society in the hope that some interesting knowledge may be brought to light and a useful discussion commenced that will help to obviate, or at least palliate, the evils that exist from the soldier becoming non-effective on account of more or less preventable troubles to the feet.

In support of my contention regarding the importance of this subject allow me to quote from authors of standing and experience in foreign armies. The most interesting work devoted entirely to this study that I have been able to procure, is a book written by Brandt von Lindow, truly a triumph in literature, and a treatise reflecting unbounded credit upon its author. He states that in the German Army out of about 400,000 men not less than 60,000 are annually reported sick from troubles to the feet; that when he commanded a battalion, in the peace manoeuvres of 1882, out of 502 picked men 55 went sick with foot troubles on the first day, and of these 36 were cases of blistering; on the second day 38 cases, on the third day 15 cases—all blisters. The road on which they marched was level, hard, and well kept, and the weather most favourable; the boots, as far as could be ascertained, were in good condition. He calculates, from

German hospital statistics, that the German Army loses 400,000 working days of its men in every 12 months from foot troubles. Again, from carefully compiled statistics we find that a force consisting of 7,500 men marching in the neighbourhood of Wiesbaden, just prior to the battles of St. Privat and Sedan, 1,217 men were sent back to the base hospitals, exclusive of wounded—16 per cent. of these for foot troubles—and before the battle of Sedan this force had permanently lost 166 men from sore feet in two days. In the French Army Touraine states that after the first day's march from 25 to 30 per cent. of the men were reported sick from foot troubles; and again let me mention that in the American War of Secession an Army Corps of the Northern States started on the line of march, but after 14 days had to halt for several days, as more than half the men had become non-effective on account of troubles to the feet. Finally, gentlemen, let me record the experiences of one unit during the early days of the recent Autumn Manœuvres at home. I refer to the 2nd Battalion Scots Guards, with which I had the pleasure and honour to be doing duty. Let me tell you first that Major-General Lord Methuen, Commanding the Home District, had taken great interest and unremitting care for several weeks previous in the marching power of the Battalions of Guards proceeding from London; he had organized route marches and frequent inspections of the men's feet, boots, and socks, and these, as far as regards the battalion in question, had been faithfully and most carefully carried out. Now, gentlemen, in spite of all this care the first really trying march we underwent—from Hounslow to Pirbright, a distance of about 23 miles—resulted in my having to attend to 25 cases of sore feet the following morning; this, however, not representing the number of those existing in the battalion, as I am proud to say that all ranks had by this time become imbued with a glorious spirit of emulation, and the vast majority would have undergone an almost incredible amount of pain and discomfort rather than "fall out," but after three days' comparative rest and time to repair boots, &c., the first march to Hazeley Heath resulted in 32 cases of sore feet requiring treatment; each successive march brought out diminished numbers however, and I can speak with authority when I maintain that, as a general rule, the other battalions of the division suffered to a much greater extent. I could multiply these examples almost indefinitely, but time, and doubtless your patience, will not permit, but I trust they will suffice, gentlemen, to satisfy you that by introducing this subject for your consideration I am not starting a hare unworthy to be shot at, but endeavouring to remedy what is surely proved to be a matter of great trouble to those responsible for the marching and fighting power of the soldier, and of which Brandt von Lindow in his enthusiastic eloquence says, that "Foot ailments therefore lessen not only the number of serviceable recruits but also the number of soldiers required for daily duty, they render defective the marching powers of the soldier, they diminish the pleasure of the soldier's calling, they tend to make him pusillanimous, faint-hearted, and churlish, and they fill the hospitals." And when Marshal Saxe and General Foy, in

their Memoirs, write, "War in modern times consists so much in the science of making men march, for the purpose of striking an unexpected blow on the enemy, that the secret of war lies in the power of marching," if such men held this opinion in their day, how should we apply it to ours when the rapidity of musketry and tactics has increased enormously?

The first question that naturally will require an answer is: *How* are we to fulfil the requirements of the age? And when one looks back into the history of the many praiseworthy efforts that have been made by officers and other officials in this direction, and then into statistics of the results, the answer indeed appears an enigma. However, it is with the object of gaining even one step up the ladder of useful knowledge that I now proffer you the results of my studies on the subject.

To begin with, let us define our enemy and consider how to combat him afterwards; it is with the preventable types of foot ailments that I propose only to deal in this paper, as there are conditions of the feet rendering soldiers unfit for marching, such as deformities of marked degrees that concern only the medical profession, and I trust that by avoiding technical terms I may render the study easy and comprehensive to all. The type, then, of sore foot from which the soldier mainly suffers is, I humbly maintain, a *preventable* one—it is that condition where the outward skin is damaged or entirely removed and the inner and tender surface exposed. To make myself more intelligible, let me draw your attention to this diagram of the skin, where you will observe a thin whitish layer on the upper surface: this represents the outer skin; it is composed of horny, elastic scales, disposed in layers, and is an insensible covering to this (Fig. 1), the inner, or sensitive skin; this is thicker, and is composed of living cells, blood vessels, and nerves, and a portion of the human organism in which life, with its many processes, is extremely active—between these two layers there is a more or less defined space, and I mention this particularly, because it is the situation in which the fluid collects when a blister is formed. (Fig. 2.)

Here, for example, is a vertical section of a blister—the outer skin separated from the inner by this collection of yellowish limpid fluid. I maintain, then, that there are two kinds of sore feet the soldier and his leader have to contend with, and as they require different treatment I think time is not wasted in defining them. First, we come across cases where the outer skin is rubbed rapidly away and destroyed by some high degree of friction or some projecting object in the sock or boot, and a raw, tender, and sometimes bleeding surface of this inner skin is exposed. In the other we find the outer skin intact but raised and stretched by subjacent fluid, this suggesting a less degree of friction than the first type, and no offending projection in the foot's covering. I maintain, gentlemen, that the detection of these types of sore foot and their successful treatment can be carried out by any person of average intelligence, certainly by officers and non-commissioned officers, and thus much suffering and loss amongst their men be avoided, and it is with the hope of attaining this end

that I mention these few plain rules and simple explanations to serve as a guidance. The appearances of these two kinds of sore feet are here roughly represented. (Figs. 3 and 4.) In the first, one usually finds a large surface affected, frequently running from heel to toe, a large red surface with steeped and soaked-looking patches and a more or less sticky, acrid, irritating discharge covering it. This is a very painful type and requires a special treatment, hence my object in describing it separately from the second kind, which is really an ordinary blister, and in which the friction and injury have not been so acute;

Keeping in mind, then, these two varieties, let us study the mode of their production and then we shall better comprehend how to prevent their occurrence and treat them when they exist. What is the meaning of this generally swollen and congested foot? It implies that the blood in the foot has been subjected to some obstruction in its circulation: that thus the foot has become congested and swollen, that an abnormal amount of perspiration has been secreted, and so the skin's surface has been steeped and softened; that some friction has taken place on this swollen and softened surface, and consequently the outer hard protecting layer of the skin has been lost and the inner sensitive skin exposed.

In the case of the soldier, my observations have led me to the conclusion that the most potent causes of this state are to be found in the equipment he wears, the fashion of folding a voluminous portion of trouser within a non-porous leather box, such as the legging represents, means retention of heat; this causes congestion of the lower part of the leg, which consequently becomes swollen; thus pressure is increased within the leather legging box, and as the blood returning from the foot is mostly conveyed along the veins lying just beneath the skin of the lower part of the leg, the flow of blood is obstructed and hence the foot becomes congested and swollen. In addition, let me tell you that this congestion and increased heat means increased perspiration, soaking of the trouser and sock, and as there is practically no chance of evaporation it is easy to understand that this also increases the pressure, and so the evil influence of the cause is reflected back from the effect, the one thus acting upon the other and multiplying the results in an inverse ratio. Who, indeed, when attending to a soldier complaining of sore feet, wearing this equipment, has not observed on the removal of his legging a regular cloud of steam issuing from a soaked trouser, and the abnormal amount of heat is plainly felt by the hand and only too evident to the suffering patient?

The second type I have referred to is the localized injury here pictured (Diagram II); in this we may have a single blister or a raw place when the outer covering of the blister has been ruptured and rubbed away; this condition is usually produced by some local pressure, such as a knot or fold in the sock or a projecting part of the inner lining of the boot, but it may also occur just on the point of the heel when the boot is too large and the heel has been working up and down within. I have very often seen curiously shaped blisters

running diagonally across the sole of the foot, and as the outer skin is here very thick, these blisters seldom burst and the pressure of the body's weight in walking pushes the fluid across the sole; this kind requires a special treatment, which I will deal with later on, but let me now mention that if properly treated they may cause practically no inconvenience, whereas neglect or improper treatment will result in a troublesome ulcer or sore on the sole of the foot which very frequently lays a man up for several days or even weeks.

I trust this crude description has enabled all who have honoured me with sufficient patience to comprehend the nature of this malady, so painful to the sufferer and so disastrous to the marching and fighting power of the soldier who becomes its victim. Having, then, a sight of our enemy I beg to lay before you the means I propose wherewith to combat him.

Regarding the general swelling and heat and the soaking of excessive perspiration so frequently seen in the infantry soldier's foot and the lower part of his leg, I trust I may be pardoned if I boldly condemn the present fashion of folding a thick and generally voluminous trouser within a non-porous leather legging, as generally adopted for the infantry soldier of the line in our army, and to advocate an arrangement whereby all undue pressure may be obviated, and a more or less free current of cool air be encouraged to play in the space between the leg and its covering, and I suggest that this can be arrived at practically without expense and without adopting any new or radical change of equipment; my plan being to allow all the men time-expired or part worn trousers, which are at present used as "swabs," to be cut short and worn hanging loosely over the upper part of the leggings, a fashion almost generally adopted by officers; by this means the circulation in the lower part of the leg and ankle need not be obstructed, a fairly good degree of evaporation is allowed from the leg, and cool air encouraged to play in the space between the skin of the leg and its covering. Of course, for show parades, guards, &c., this would not be practicable, as the "swab" is not quite the dress any of us would like to see beneath a new tunic, but such occasions are not a severe enough trial upon the foot gear to cause sore feet; and it is only with the marches, manœuvres, or active service that this paper proposes to deal, when, in fact, the tunic and a great deal of the kit is part worn; there is no reason why these "swabs" should be very unsmart, as they are easily cleaned, and certainly, with ordinary care, would not lose by comparison with our manœuvring or active service tunics. Another question, however, may suggest itself to most of you, that is, what is to take the place of the "swab trouser" when it is cut short? The very first question, in fact, that our efficient and energetic quartermaster confronted my humble suggestion with, and I assure you, gentlemen, that he turned upon me with a look and a meaning in it that was truly the quartermaster all over; but I assuaged his anger, as I hope I may now clear your doubts, by mildly suggesting that the swab, when cut to the length usually adopted in the officers' marching trouser, would still fulfil all

its duties, as well as, or even better, than when hanging to the foot, when, indeed, one usually sees the soldier turning the lower part nearly up to his knees; for pioneers, of course, an old trouser is required to work about barracks in, and it would not do to have it cut short, but methinks the pioneers have many pairs of old trousers, and one might be kept for hard marching.

The treatment of a disease may generally be divided into preventive and curative. The plan I have just described may be regarded as one of the most important kinds of preventive treatment for a sore foot, and I now propose to deal with the foot's coverings from without inwards *seriatim*.

First, as regards the boot, and when considering this important part of the equipment it is absolutely necessary to know something of the external anatomy of the foot. There are three points in the sole of the human foot upon which the body's weight chiefly rests, and any one can demonstrate this by stepping out of a bath on to a surface that will take an imprint; it will then be observed that the pattern is as here represented. (Fig. 5.) You will observe that the heel forms an almost equilateral triangle with rounded edges, the anterior angle fading gradually away into a thin line running towards the ball of the outer toe; here, again, is the mark of another triangle with its base directed outwards and backwards and its inner angle more or less continuous with this, the third point on which the weight of our body rests, and which corresponds to the ball of the great toe. You will observe that these two front points are not equidistant from the heel, but that the inner is placed more forward than the outer. What does this teach us?

Why, that the shape of the sole of our boot should be made to correspond, and that the broadest diameter of the sole should not run transverse to the direction of the foot but obliquely from without, forwards, and inwards. The important points in all this are that the joint on which the foot principally bends acts in the direction indicated by this oblique line, and that when the heel is lifted from the ground the joints composing the base of the toes are so beautifully constructed that they enable a marked expansion to take place along this oblique line, thus diminishing concussion and giving the muscles a grand leverage in propelling the body forward. Our boot, therefore, should have a sole constructed so as to allow this expansion and be perfectly smooth on its inner surface to prevent friction. All the best boots of modern manufacturers are made on this pattern. Does not this also show us where the sole of the boot should bend? Along this oblique line, in fact. Made upon the plan thus taught by Nature, I maintain that the heel of the boot will rise with the heel of the foot in progression, that the necessary muscular power is reduced to a minimum of expenditure, and that friction may be almost entirely obviated. Let us examine the regulation boot at present in use, and, with all due deference to the experienced heads that designed it, I aver that it does not fulfil the requirements of Nature. In the first place, the waist is made of two layers of stiff leather stoutly sewn together by four rows of waxed thread, and forms an

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almost unbending bar. In the manufacture of this part of the boot the thread runs through heated wax which, when set, still further fixes the layers of leather together. Again, the little play that the sole does possess takes place too far back, and not in the position of Nature's oblique line. Consequently, in walking, the only movement practicable in this boot is a sort of roll from heel to toe, for the heel reaches the ground first, and as the step proceeds it is lifted, and finally the toe alone rests on the ground, on the principle of what engineers term the "roller or rocking lever." (Fig. 6.) But the tendency of the foot within is to bend at the joints I have already named, and consequently the tendency of the heel of the foot is to act independently and work up and down within the boot. Again, this boot is lined along the sole with a thin layer of sheepskin, which, when wet, will stretch to an extraordinary extent, thus giving rise to folds which become hard and cracked when dry, and cause great irritation to the foot. I here show you some examples of this taken from my own battalion.

As proof of the unscientific make of this boot, I would draw your attention to a fact that has frequently interested me much; doubtless, you have often observed that some boots after being worn a short time become permanently turned up at the toe; the chief cause of this I think may be put down to the sole being wrongly constructed, that in fact this boot has been doing its duty on the rolling principle instead of bending at the proper situation corresponding to that of the foot, and these regulation boots certainly demonstrate this theory extensively.

There is great difficulty in retaining the original shape and construction of these boots, because the soldier, and particularly non-commissioned officers, will persist in having them altered to suit their ideas of fashion, generally having them refronted and made so short that the foot cannot possibly work naturally, the toes being pressed upon and bent inwards and so deformed into various shapes, besides being predisposed to attacks of cramp in the toes and muscles of the sole of the foot. Therefore, I have been most careful in selecting examples for study to see that the original boot has not been altered in the shoemaker's shop.

How, then, you will naturally ask, do I propose to lessen the defects of this boot? And, in the first place, allow me to say that no ankle boot can be supplied to a great number of men without some defects; the best covering for the foot that has to perform severe work is that which covers it the least. For marching, running, jumping, &c., a boot which confines the ankle is a mistake, and most people agree that a shoe, when well fitted, is preferable, though it is without much hope of success that I beg to put forward for approval an equipment here represented. You will see that the shoe can be fixed with one fastening, and that it is made on a very pliable pattern. The advantages I claim for a shoe are—

1. Rapidity of adaptation.
2. Cheapness.
3. Lightness.

4. The ease with which the regimental shoemakers can adapt its shape to any peculiarity of the man's foot.
5. Much greater ease with which a spare pair can be packed and carried in a man's kit.
6. The ease with which it can be removed on a march, and the foot cooled, or any irritating condition remedied.

For instance, should the rim round the heel be pressing on the foot, a very slight padding of cotton wool will rectify this, and a medical officer with a force on the march, I maintain, should never be without this necessity. At the five minutes' halt, now generally allowed each hour of a march, ample time is given to remove a shoe like this, cool the foot, and remedy any defect; but when the legging, trousers, and laced boots have to be dealt with, you will find a man will generally prefer to run the risk of its getting worse than take all this trouble.

The disadvantages of a shoe are that dust, sand, and other foreign bodies are apt to get in between the rim and the foot, and that there is no support to the ankle; both of these are obviated by this my combined spat and legging, in which you will observe a strong spat that can be tightened or loosed at any point by means of these buckles, and that can thus be made to bring support on any particularly weak point. One of the most efficient means of treating "flat foot" is a shoe with a bar of steel running along its inner face and padded to press upon the inner wall of the foot, that part, indeed, which has given way and is spoiling the natural shape of the arched buttress that the foot and ankle comprise; and, gentlemen, I maintain that this shoe and spat very closely resemble this surgical appliance.

As evidence of the advantages of a shoe over a boot for hard walking, take the opinions of men who shoot over all sorts of ground, and you will find the majority are much in favour of the shoe and spat. I have frequently watched with interest the wonderful amount of walking that is done by the fishing communities of the East Coast: women will, in fact, walk over 20 miles a day, half the time supporting on their back enormous weights of shell fish for bait; these are what are called "Flither-girls," and to procure bait they often have to walk great distances. Now, it is seldom you find these hardy women wearing anything as foot gear but a strong shoe and a thick stocking, and how about support to their ankles? They have much heavier weights to carry than the soldiers. Further, let me assure you that the muscles and tendons of the foot and ankle require constant exercise, and that when deprived of their natural work they decay and waste, as will any muscle of the body. This we see extensively exemplified in the recruit, who is drawn from a class that wear stiff, straight boots from childhood—in many cases wooden clog soles—and nearly all exhibit wretchedly deformed and atrophied tendons and muscles of the feet. Their walking is done on the rocking lever principle; the foot cannot bring into play its magnificent arrangement of arches and levers; but with proper covering all these might be restored, and the ankle cease to require support. The appearance

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Fig. I.

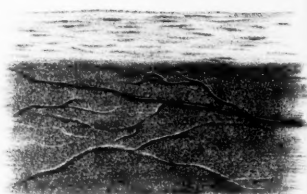


Fig. II.

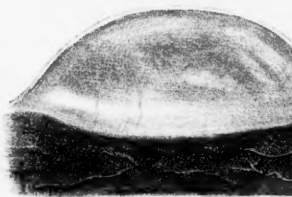


Fig. III.



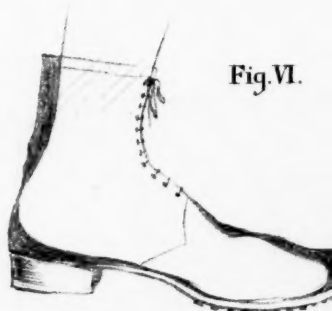
Fig. IV.



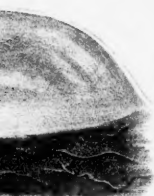
Fig. V.



Fig. VI.



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Fig. VI.



of the feet of athletes definitely proves this theory ; and, again, think of the weights a Scotch gillie can carry for long distances over thoroughest of ground, and I should say 90 per cent. of them wear shoes and do not suffer from sore feet either. The experiences of Highland regiments and pipers in the Scots Guards also strongly supports the theory of the advantage of shoes over boots in marching. Mr. Blair informs me that he very seldom, in fact almost never, has a complaint about the shoes supplied to Highland regiments ; and what would any commanding officer say about the boots of his regiment ? Let anyone examine the lacing of the boots of a battalion of infantry on parade, and I will warrant, from experience, that a vast majority will be found to have left unlaced the upper two or three eyelets of the boots. What use then can they be making of the surplus leather above the ankle ?

Marshal Saxe in his *Memoirs* says : " In regard to the legs and feet, I could wish the soldiers were to have shoes made of thin leather, with low heels, which will fit extremely well, and make them involuntarily assume a grace in marching."

The idea of support to the ankle is chiefly an imagination, but there are those who say they cannot walk far without it, and I beg to put forward this spat and legging as a more adaptable support than a boot.

It will, doubtless, occur to many minds to ask what is the soldier supplied with this kit to wear when he is not using the spat and legging ? To which I answer that the shoe will surely fulfil all the requirements of an every-day soldier's life, will look smarter, will be more easily repaired, and will last longer than a boot ; and for long marches the spat and legging over the shoe I humbly tender as a much smarter-looking kit than our present legging and boot, which one so often sees wrinkled out of all smartness, and the boot with its toes turned up and frequently much on one side.

Regarding boots, perhaps, I may give you some interesting information gathered from various sources ; and here I beg to put on record my gratitude to Mr. Blair, the inspector of army boots, who has assisted me greatly and most cheerfully in obtaining information for this paper. Boots, as most of you will know, are manufactured on two principal plans, sewn and rivetted. The former ones are either hand or machine sewn. The experience of the last 10 or 15 years has taught us that there is no doubt which is the best boot of the two—the old-fashioned hand-sewn boot is infinitely superior ; but, as Mr. Blair says, it is at present impossible to procure a supply of hand-sewn boots sufficient for our army, on account of the youth of our day not being educated to the skill necessary for the manufacture of these boots. The British workman in this, as well as in many trades, is being spoilt by the greed for gain and easy work, and our younger men cannot be induced to sit down and, as an apprentice, learn a somewhat laborious though profitable craft when he can earn a "living" ! in a much easier way by sitting still and guiding the needle of a machine. The manufacturers all affirm that men cannot be procured in sufficient numbers to make hand-sewn boots for large contracts.

The boot served out to our whole army some 10 years ago was a most excellent one; it is called the "Ammunition" or "Tommy" boot; it is hand-sewn and made of very good material, and I would like to tell you the history of one pair. I bought them at the Ordnance Store at Suakim at the commencement of the campaign there in 1884, wore them all through that campaign, and after coming home I used them for shooting, fishing, and all hard walking for $3\frac{1}{2}$ years. I finally gave them to my groom, when they were still in good repair. I have often heard officers speak most highly of these boots, and my old friends whose history I have just given frequently met their kindred at shooting parties. This pattern is, however, at present supplied to our troops abroad; but in India last year they organized the manufacture of boots themselves, and are teaching the natives to make the hand-sewn article. The other kind of sewn boot is made by machinery, but is not so durable or so pliable as the hand-sewn one. Although this boot is of good manufacture, it also is too stiff in the waist. No soldier's boot should be rigid in this situation. From experiments, I find that a force of 3 lbs. is necessary to bend the sole of what one may call a supple boot as regards the sole, and a force of 28 to 30 lbs. the average military boot. What does this mean to the soldier who has to take from 25 to 40 steps in each minute on a march? The strain on the muscles is terrible, and, in fact, I find he soon ceases to bend the ankle as in a natural gait, and succeeds in placing one foot before the other by means of lifting the lower leg by the muscles of the thigh, with the knees bent, and adopting the "plod" of the agricultural labourer. Walk behind a battalion of our infantry, gentlemen, and I'll warrant you will not fail to observe this fact.

In 1860 the authorities at Horse Guards held an inquiry into whether it was necessary to have the soldier's boot made rigid in the sole in order to make it sufficiently durable; they selected an orderly whose duties required him to walk from 6 to 10 miles a day. They supplied him with a pair of boots with rigid soles; these wore through in seven weeks; then with a pair made with Dowie's "elastic waist," and these lasted 13 weeks, the conditions of work in each case being exactly similar.

Of the pegged boots there are, roughly, three kinds, those made with wooden pegs, those with metal ones, and those with screws. The first two I will dismiss by saying I cannot recommend them as soldiers' boots; of the third kind, called "the Standard screw boot," made with brass screws, I have heard very good accounts, and they are now being tried in our army, particularly in the Volunteer forces. Here are the two kinds. This first, named "the Volunteer boot," is made with these screws, which are driven by machinery through the two layers of leather composing the foundation of the sole; they are screwed in under high pressure, so that when this pressure is removed the leather expands and the screws become firmly imbedded. I show you here a vertical section through the sole which exhibits the screw imbedded, and here a strip of the sole which shows that this plan renders the boot much more pliable than if these two layers

of leather were fixed by four rows of waxed thread. The boot at present served out for experimentation in the army is made with the standard screw as a foundation, and a clump sole rivetted on with steel pegs. I must say that I think this a better boot than the one at present in use, and this, I understand, is the opinion of Mr. Blair. One more make I would like to describe: it is this, in which the sewing and pegging are combined; the sewing is done by hand in our own regimental shoemaker's shop, and designed by our regimental sergeant shoemaker; it is an excellent boot, very easy and pliable.

Cost is of course an important consideration in recommending an article for use in the army. Now this latter boot costs 12s. a pair to make, retail, in our regimental shop, and we consider that three pairs of this pattern will last as long as four pairs of those at present in use, which cost 9s. 4d. a pair. In two years, therefore, the country would be saved 1s. 4d. each man, for at present they give each man four pairs in two years, each costing 9s. 4d., which comes to 1l. 17s. 4d.; and if three pairs were served out at a cost of 12s. each, it would amount to 1l. 16s.; but this is retail price, and doubtless if tendered for they could be made cheaper, and still further save the country money.

I claim, in support of my suggestion of shoes being substituted for boots, that they can be made much more easily than boots, and at a much less cost.

A most important point, to my mind, is that every boot or shoe worn by a soldier should have light heel and toe plates. In long marches, I think the toe plate most important, for no matter what trouble is taken to have boots properly repaired before starting, it will be found that the sole of the boot very rapidly wears out at the toe, and the officers who were with our brigade on the recent manoeuvres will, I feel sure, bear me out in this assertion, one march of about 20 miles will wear away the toe of many a man's boot. You will naturally ask how on earth this can be? And I think it may be explained by the fact that a soldier, after marching for some little time along an uneventful and uninteresting road, the very boredom of the journey makes him drag his toes along the ground, and so wears away the leather in this situation, and any officer marching with a force may see when men are wearing stiff-soled boots that the action of their gait is one of the rocking lever and a screwing motion laterally, which rapidly wears out the boot.

A most important consideration in connection with the soldier's boot or shoe is the treatment of the "upper" when it has to undergo hard trials; for this various compounds have been designed, and their value proclaimed. But it matters little, to my mind, which dubbing is used, so long as it is properly applied, and no dubbing that has bee's wax as its base can soak well into leather. The present regulation of making the men oil the boot first and then dubb it is an improvement; but, after many trials, I beg to suggest that vaseline be substituted for oil. An old stud groom once told me that nothing equalled vaseline in softening and preserving leather, so I have tried

it on boots, and find its penetrating power far above that of any oil; being solid petroleum, it preserves the leather, and if it is thought necessary to apply some dubbing, in addition, to render the leather waterproof, it can readily be rubbed in after the vaseline has more or less dried into the leather. Of all oils for leather, I submit that none have the penetrating power of neats foot oil. Anyone who has had experience in campaigning with the soldier will have seen how difficult it is to keep his boot soft; the fact is, that most leather, when soaked by perspiration, will become hard, and even brittle, as the perspiration dries into it, and the greatest care is required to prevent this evil taking place, hence the advantage of a penetrating material like vaseline; give it, the first "look in," and so defeat the perspiration and its evil after effects.

Each soldier should be made to wear his boots or shoes on alternate days, and I think a capital plan is to make them put on clean socks and the clean spare pair of boots after each march or fighting day, and so give them every opportunity of attending to those that have been worn during the day.

Of course the tanning of the leather has something to say to this hardening tendency, and I understand that this industry has suffered in late years, like so many of our trades, by the hurry to realize profit, hence rapid tanning is practised, and leather so treated is soft and absorbent in the centre, and should perspiration soak into it this centre will, on drying, become hard and brittle. This condition of leather ought, in my humble opinion, to be made a matter of special enquiry when it is discovered in the boots supplied to our army.

The next covering to the foot we will now consider is the sock, stocking, or foot cloth. Of the requirements of these I think I need not detain you by a lengthy consideration, as everybody is aware of them; but a few words about the socks, &c., supplied to our army and those of other nations, may be of interest.

First, let me describe the covering generally worn by European nations. In most of them it is a woollen sock; this includes ours; but in Germany the soldier is allowed to choose between a woollen sock, a cotton sock, or a foot cloth; the latter is a rectangular piece of linen, thin flannel, or fustian. Many men prefer this to socks, and as it is something we do not usually see, I have made experiments as to their merits and demerits, and have come to the conclusion, adduced from personal experience, that they are not an equipment to be recommended for general use in an army—they require some skill in being put on and fixed, and I consider that the only way in which they are to be made comfortable is to wear them under a thin cotton sock; as they may be an entirely new arrangement to most of my hearers, I will apply this one to my own foot in your presence, and cover it with this thin sock. Many trials have been made at Aldershot with these foot cloths, and they have been almost universally condemned, the chief complaint being that they are too cold for this climate, and are an insufficient covering to the ankle; if, however, a sock is worn over them, this objection is got over. The Germans who use them fix them either with string, bandages, or a

sock, and for some men they are an undoubted advantage, for I assure you that many a soldier is quite unable to wear a woollen sock, in a boot, at all events, and they prefer to wear nothing of the sort at all, but march with merely the bare foot within the boot. We can surely understand this when we consider that probably they have been brought up from childhood into early manhood without the use of socks or boots of any kind, and consequently their feet easily get very hot when clothed and confined in a limited space, the result of this being the evil sequence I described when talking of the fashion of overheating the foot by tucking the trouser inside the legging. I know several men in my own regiment who habitually march without socks whenever they can escape the vigilant eye of the inspecting officer or non-commissioned officer, and for my own part I have learnt the advisability of looking the other way when they have come under my notice. I now beg to recommend that in our army we should adopt the plan of the Germans, who allow their men to wear whatever they please in the way of socks, or none at all. Von Lindow states that out of every 100 German soldiers, 56 use foot cloths, 11 cotton socks, and 33 woollen socks in winter; and in summer, 61 use foot cloths. This induces me to strongly recommend a voluntary trial of these foot cloths in our army, and I consider every medical officer should be made cognisant with their mode of application, in order that they could educate the men accordingly. The advantages of these foot cloths are their lightness, durability, facility of cleaning, and on a march the rapidity with which they can be changed when hot and damp with perspiration.

Regarding socks, I strongly advocate the German principle of supplying the soldier with cotton as well as woollen ones. Lately, the brigade of Guards has used a well made woollen sock in which there are no seams, and consequently no knots or irritating threads, but I regret to say that they wear out very rapidly. I have tried them myself in all sorts of ways, and come to the conclusion that the material is not sufficiently durable, and is too heating to the foot. The Regulation, or what we call the "ammunition," sock, has many disadvantages; it frequently has knots in the seams, its texture is too rough, and it is too heating to the foot. The absolute necessity of proper fitting I need scarcely impress upon you, but in spite of this, I assure you that the men, when being equipped for manœuvres or active service, are generally very badly fitted. After much care I have found them with socks 2 in. and 3 in. too long, with the result that they have wrinkled in all parts of the foot, and the heel, at first drawn nearly up to the calf of the leg, has gradually worked down and become an irritating lump in the sole of the boot. It is no use saying that they should be too large at first, to allow of shrinking in the wash; I maintain they should be supplied in a condition in which shrinking has already been carried out, and the sock is an accurate fit; in fact they should be fitted by the men themselves in the barrack room, where they have time to take an interest, and when the hurrying eye of a non-commissioned officer does not flurly them in this important undertaking.

Finally, in the preventive treatment of a sore foot, the care of the skin forms no small desideratum, the importance of cleanliness cannot be overrated, and frequently the difficulty of enforcing it is great. During the recent Aldershot manœuvres a most excellent plan was carried out in our brigade, whereby all the men who had been on a march or field day were ordered to wash their feet and legs, and show them clean at some convenient time that did not interfere with tea. My commanding officer and all company officers took a most praiseworthy interest in these inspections with the most satisfactory results, and here are two tables which will prove this statement.

Some may say this is because their feet got hard. Granted; but I strongly take up the position of considering this one of the most efficient of the means adopted in attaining this satisfactory end. All the German, Russian, and French scientific authors condemn their countrymen for their culpable neglect of cleanliness to the feet, and agree that for the soldier on the march it is a most important consideration. The chief reason, I may make plain to you, by saying that perspiration, when dry, deposits acrid, irritating crystals of animal acids, and if they are left on the skin, the next time perspiration occurs they dissolve, and you will see that, if not washed away, the perspiration becomes strengthened each time it takes place, and the skin is actually burnt, as by vitriol or any other strong acid. Many substances have been vaunted for their power of hardening the skin of the feet, and powders and solutions of all kinds recommended; but after an extensive trial, for my part I prefer common salt or saltpetre. A handful in two quarts of tepid water I recommend as the best hardening solution for the skin of the foot. So much for the preventive treatment of sore feet in the soldier.

Finally, gentlemen, I would like to draw your attention to my statement that any officer or man of ordinary intelligence can be educated to treat the usual soreness of his own or his comrade's feet, and I will conclude this paper by giving you a little simple instruction in how to treat the sore foot when it has occurred.

This first type you will find very frequently in the first few days of a march, and to treat it I recommend strict attention to cleanliness, the giving of every facility for the man to cool his foot on the march, and the application of a thick layer of common zinc ointment. The German linen foot cloth worn under a cotton sock is undoubtedly a good plan to prevent this type, and when the foot has been well covered with ointment, the linen is most gratifying as a covering.

For the treatment of the various kinds of blisters, allow me to recommend a special way of opening them that I wonder is not more widely known. The stretched outer skin actually enclosing the fluid should not be punctured, because when it is, it generally gets torn and broken away, leaving a raw tender surface exposed. But the needle or knife, or any puncturing instrument, should be inserted in the sound skin, about $\frac{1}{2}$ in. beyond the edge of the blister. The needle is then passed horizontally into the blister, and, if raised, you will find the fluid will run out beneath it. When as empty as

possible, the skin protecting the blister should be carefully flattened down, and some cotton wool, lint, or anything that will exert soft pressure, placed over it, and fixed by some strong strapping. Now, I maintain that all this can be done readily by any person. Frequently you will find a blister refill, and when it does, all that is necessary is to repeat the little operation described above. The skin will soon become hard, and as the fluid disappears the raw surface beneath loses its tenderness, and gradually assumes the character of ordinary skin. The blisters on the hand produced by cricket bats, fishing rods, guns, &c., can be treated in this way also, and I beg to tender this remedy as a certain means of preventing the pain of a blister, and so enabling a soldier with a blistered foot to march merrily on instead of being in the ambulance, and the sportsman to enjoy the exercise of his skill without the galling discomfort of a blistered hand. I mentioned strong strapping as necessary to cover the cotton wool or lint pad, and I have here what I consider by far the best strapping I have met with. It is called "Mead's India-rubber Plaster," and can be applied without heat. This is a great advantage. Its adhesive power is quite wonderful, and being made of linen, it will protect a raw surface and prevent friction. In the Army Field Panniers they have supplied this plaster, called "American Indianrubber Plaster," which is very good, but not quite equal to Mead's. I recommend every officer on manœuvres or active service and every sportsman to have one of these reels of Mead's plaster. As to the distribution of some ointment or powder, whatever it is, I prefer zinc ointment. We have found it most useful to let each Pay-sergeant have a stout earthenware gallipot, and encourage the men to come to him and freely grease their feet before and after a march.

In conclusion, I would add that, although I am afraid that the details into which I have gone may have been tedious to listen to, I hope they will have interested you at some points, and that this humble and necessarily crude attempt of mine to draw attention to a serious defect in the equipment and care of the soldier in nearly all armies may draw some useful information from experienced heads, and lead to a discussion and subsequent action that will palliate the evil in our own army, and give commanders and their men a confidence and assurance not hitherto enjoyed.

Lieut.-Colonel J. A. FERGUSON (Royal Military College): This is a subject in which I have taken some interest, and which I have often discussed, especially with one who has risen from the ranks, and is one of the best soldiers I ever met. Seeing this lecture advertised, I wrote to him, and asked him to put in plain words in writing what he had often said to me, and perhaps I may venture to read it, as it corroborates very forcibly what the lecturer has so ably and scientifically explained to us. He says first of all, "the machine clumped-soled boots are hard and clumsy, and do not give"—an expression used by the lecturer—"but gall and tire the feet, and are very uncomfortable for marching. (2.) They will not stand the same number of soles as the hand-sewn boots, and do not wear well. (3.) Their facility for repairs is not equal. The clumped boot is far inferior, and is not liked by those who have worn the hand-sewn boots. The men get very tired after about a 14-mile march; the feet become numbed and blistered. The men seldom leave their tents after arrival in camp, owing to these causes. In connection with the wear of the boot it must also be remembered that the ordinary

marches nowadays are only about half the distance they used to be, and that the weight of the valise equipment has been considerably reduced. The hand-sewn boot has a broader welt; it is flush heel and toe. The waist and the sole are one piece, and the boot will give in walking, whereas the machine boot is clumped, that is, the outer sole is separate from the waist, and will not let the feet bend when walking, hence numbness and galling, caused by the circulation being impeded. The cost of the hand-made boot is 2s. 6d. a pair more than the machine-made boot. The first year they were worn the authorities saved a considerable amount upon the estimates; complaints were frequent, but no notice was taken of the matter." Now, Sir, we do not require to be told of what vital importance it is that the army should be able to march, but perhaps the public do not quite realise that. The old musketry regulations used to say that the soldier who could not shoot was a nuisance and an encumbrance. I am quite sure that the soldier who cannot march would be a much greater encumbrance. The applause which followed the lecture showed how thoroughly it had been appreciated. I do hope it will not fall idly to the ground. The question is one of national importance, and is, indeed, most pressing. It would be a terrible thing to go into a campaign with a European Power with the boots now issued to the army.

Dr. A. EDDOWES: Years ago, when in general practice in the country, I did not know what it was to suffer from any trouble in my feet. When I came to London and walked more, upon hard pavements and in London boots, I soon suffered acutely from corns. This induced me to study the subject. After the long marching competition at Kingston, I was allowed to see the condition of several of the competitors' feet. A few were very sore, but the worst case was that of a volunteer, whose boots had caused a long wound, corresponding to a hard, chisel-shaped edge of the lining of the sole. The uppers had become sodden, and the feet swollen, consequently the flesh had overlapped a sharp, hard ridge, which with friction had literally cut the skin. The subject is so wide, that I must be content to discuss merely its most important features. Firstly, as regards the anatomy of the foot. Its shape is that of a double wedge or plough-share, the apices of which are respectively the toes and outside of the foot. It follows, therefore, that when the foot is thrust forwards into the boot, it must also take an outward direction, especially when the heel, owing to pressure, expands in insufficient space. A trivial thrust forwards will tighten the more or less flexible arch covering the instep, with the result of causing considerable resistance at the outer side of the foot or apex of one of the wedges. A little reflection will show what this means. 1st. That the foot tends to work over to the outside of the forepart of the boot. 2nd. That this natural tendency must be met by some mechanical arrangement. 3rd. That the smallest toe is very liable to injury from pressure and friction. The first point, which is of the greatest importance, it seems to me has been entirely overlooked by those who have hitherto written on the subject. I have endeavoured to meet this difficulty by the employment of an instep strap, which passes from the posterior half of the arch of the foot obliquely forwards over the instep, ending on the outer side of the foot, just behind the base of the little toe. This contrivance practically converts my boot into a sandal, the forepart being merely a covering for the toes. As there is no flexion in the instep whilst walking, the strap may be made of stout leather, while the toes may be covered by a much more flexible material than is usually employed. Time compels me to pass on to another point. If you look at the diagram of a footprint which is before us, you will observe that on the inner side of the foot the heel and great toe are in a straight line. Meyers pointed this out years ago, but he sacrificed too much to it. He relieved the great toe at the expense of the small one, apparently overlooking the fact that on the outside of the foot there is an equally important straight line running from the heel to the end of the little toe. Obviously the outside of a boot should never curve inwards until the end of this toe is reached. Much of the injury done is due to the neglect of this necessary precaution. There are yet many faulty points in ordinary boots. I will mention a few. The soles are too flat and rigid, especially at the waist, and tend to produce flat-foot when laced tightly. The heels are also too flat. They should be cup-shaped, in accordance with the natural form of heel. The waist should be flexible, especially on the inner side, and curved to adapt itself to some

extent to the arch of the foot. This is of more importance than at first sight appears, as it tends to retain the heel in its proper position, and in a corresponding degree saves the toes. Messrs. Dowie and Marshall have made several pairs of boots for me on these principles.

Surgeon-Captain JACKSON, M.D., A.M.S. : Like Surgeon-Captain Beevor, I had the honour of doing duty with a battalion of Her Majesty's Foot Guards, during the autumn manœuvres of the last two years; but I had the further advantage, as far as this discussion is concerned, of marching throughout on foot, and during part of 1892 in ammunition boots. I gladly add my testimony to that of the lecturer, as to the great benefit the preliminary route marches and feet inspections proved in diminishing the number of men going sick from foot ailments. As regards blisters and abrasions, I found that strict cleanliness and bathing the feet daily in common salt and water solution, the best way of preventing and curing them. I think the bad effects of the regulation leggings have been rather overstated. The ammunition boots I wore were good and serviceable, but the soles might have been with advantage more pliable. The support afforded to the ankle by the uppers of boots is, I think, considerable. Turning up of the toes of boots is caused by the manner in which the boots are fitted, in accordance with paragraph 286 of the Clothing Regulations, where it is directed that boots be issued to the men from two to three sizes too large. Statements made to me by the men themselves confirm this opinion. The foot in marching increases as much as one-tenth in length, and more than that in breadth (Parkes), only this amount of increase should be allowed for in fitting the boots. The grand marching of the Highland regiments and pipers referred to is, in my opinion, to be attributed more to the way in which they are recruited than to any good effects of their spats and shoes. They come, as a rule, from the mountainous districts of Scotland and Ireland, and are, I believe, above the average recruits of the line of the British army. I do not agree with Surgeon-Captain Beevor when he says, "Walk behind a battalion of our infantry, and I'll warrant you will not fail to observe this fact, that the soldier soon ceases to bend the ankle while marching, and adopts the 'plod' of the agricultural labourer." Now I marched behind a battalion, and I observed nothing like a plodding step; we started off at a good pace, which was at first a little uneven, but a long swinging step was soon got into, and maintained for the rest of the march.

Brigade-Surgeon Lieut.-Colonel ARTHUR B. R. MYERS : We are much obliged to Surgeon-Captain Beevor for the manner in which he has worked out the paper. With regard to the question of boots *versus* shoes, no doubt shoes would be of very great advantage to our soldiers in certain places and at certain times, but we have to dress our soldiers for all sorts of climates and for all sorts of temperatures; and certainly in many instances shoes would not be convenient. Then comes the nature of the boot, and I think Surgeon Beevor has given us experience which proves that there is nothing much better than the ammunition boot. He tells us that his own pair of ammunition boots, bought at Suakin, carried him through that campaign, that he afterwards wore them for three or four years, and then handed them over in very good repair to his groom. I think it is quite evident that the boot was a good one. Undoubtedly it is very badly made, and for the reason, I think I am correct in saying, that they are made now by contractors, and, of course, the contractors can scamp boots in various ways. I consulted one of the chief boot makers in London on the point. He said that the practical way would be for a committee of experts to decide on the pattern of boot, that sample lasts of various sizes should be made, according to this pattern, and that every boot contractor for the Government should have them made upon these lasts. I am quite sure that we should reap great advantage from this system of having standard lasts, and that all contractors who make boots for the army should make them exactly in accordance with those lasts. Of course it is very easy to condemn socks. The fact is that most of the so-called woollen socks have not much wool in them; they are made cheaply and badly, and are full of knots, as Surgeon-Captain Beevor stated, they are never fitted properly. They get into rucks, and consequently give the men blistered feet. Not only that, but they wear badly; they are darned by the soldiers themselves, and rendered worse than useless; and I am not

surprised that Surgeon-Captain Beevor tells us that some soldiers prefer walking without stockings at all. I should like to see the materials of which the socks are made shrunk before they are issued, and then if the men have proper boots to wear, they will have a much better chance of keeping sound feet.

Surgeon Major-General JAMESON, M.D.: There is one portion of the paper I should like to allude to, and that is as to the amount of flat-footedness that exists in the British Army. It has been brought to my notice lately that in certain districts of England, particularly in Lancashire, the race is becoming flat-footed. I presume this arises from the disuse of these organs. I have had occasion lately to see some men at Aldershot, who have been reported as flat-footed, and in one regiment 19 men were so reported. I found a certain degree of flat-footedness, but not equal to the amount reported. However, about half were found to be more or less flat-footed. It occurs to me that there is a practical side to this question, and that is, granted that through disuse of the organ, or the process of evolution that is going on, flat-footedness does exist, we should endeavour to rectify it as much as possible, and I think that ought to be done in the gymnasium. Flat-footedness I consider, and we are all agreed, is the result of the weakening of the muscles of the feet or the weakening of the ligaments of the feet, and in order to improve the conditions the best thing you can do is to strengthen those muscles and ligaments. Some of the exercises in the gymnasium tend towards this. By standing or walking on the toes, say for 100 yds. forward and the same backward, the foot is arched, and the muscles are strengthened. My suggestion would be that in the gymnasium the men should be marched without shoes or stockings, so that the play of the muscles, and any defects of the feet can be seen at once and rectified by appropriate exercises.

Major F. L. DASHWOOD: I beg first of all to thank Surgeon-Captain Beevor for the valuable work he has begun and also for allowing me as an older man to work with him. Shortly after this subject was announced I wrote to him if he would permit me to assist him in working up a few facts. I may say first that the work is most important. If the principle of the lower lacing over the instep can be laid down and adopted for the army ankle boot it will spread through the Volunteer force, and to the Metropolitan Police, whose ankle boots are similar to the army. As far as I can gather about the best ankle boots we have now in the Public Service are those issued to the Post Office telegraph messengers. (See Table of measurements.) They are very much like the army boots but they have been very much improved¹ through the efforts of their medical officers, Dr. Street (now retired) and Dr. Wilson, working with the contractors, and ought we not to look upon this very much as a Surgeon's question? A Regimental Surgeon has special advantages in being able to examine so many feet and to classify the injuries found and improvements made. Speaking with regard to its national bearing I had a very interesting return from a village school in Oxfordshire. It shows how early in youth the injuries to the feet begin, also as to the general use of ready-made boots and shoes, and therefore how necessary it is the wholesale manufacturers should have some knowledge of anatomy, as also our retail sellers, and their purchasers some knowledge as to fitting. Out of 48 children examined as to their feet there were 24 boys and girls of the average age of 11 and 24 boys and girls of the average age of 7. Out of those 48 there were only three with shoes not ready-made. On the whole the feet were free from enlarged joints, two cases only among the older boys. Nearly all the older children suffered with corns. Among the younger children a few had corns, mostly under the great toe-joint, where the worst mischief begins, and by the side of the little toe. Perhaps I had better give my own experience which led me to look into this question. Looking back in my life I can remember my troubles began when I was about 14, and I have suffered a great deal, both my outside joints having been injured by narrow boots. In course of time, after leaving the army, I took up estate and agricultural work, and employed for some winters a great many hands,—perhaps 80 to 100—in draining. They were rather scattered and I had to ride or drive several miles and then walk to see after

¹ 1892. Vamp cut lower. Depressions for great and little toe joints and well blocked for other toes. Heels lengthened.

them. When I was at this work I saw these labourers wore strong lace-up ankle boots from early in the morning to late at night, and they did not seem to get wet or be uncomfortable. I went to the shoemaker in the village, but my first pair did not do because he tried to make a kind of gentleman's shooting boot. Then I went to the workingman's strong shoemaker, and he made me a pair of lace-up ankle boots. I did not have them made so heavily nailed as the labourer's ankle boots exhibited; but they were the same thick upper leathers with *low lacing* and weighed about the same as the army boot I am now wearing, viz., two pounds each. You may laugh when you look at these English labourer's ankle boots, but recollect they are men of experience in their line. A man in heavy work wants heavy shoes. You can see, if you watch a man, if he is doing heavy work he must be firm on his feet. As far as my experience goes, and I watch closely where I go on the Continent, the English gentlemen and the English agricultural labourer are the best shod for our climate and work.¹ If you go to Paris you see English gentlemen's shoes and boots copied. I recollect the late Mr. Mackenzie, the great railway contractor, when on my farm,—we were looking at the men's ankle boots. "Ah," he said, "I always used to look at the men's boots to judge whether they were fit for their work," and he added, "not only that, but when our men went over to France, the best of the French navvies copied us." I think, after that, we may think well of the agricultural labourer's ankle boots and bootmaker. Now what have we specially learnt from these low laced ankle boots? It was this, that they lace low down on the instep, and there lies the fault in the present army boots. (See Table of measurements.) I have now on a pair of the ammunition boots and socks, and thoroughly good and comfortable they are, though I fail to feel the great comfort I used to experience from the lower lacing supporting the expansion of the foot. Theoretically, I agree with Surgeon-Captain Beevor as to the stiffness of the sole, but practically on that point I do not so much think with him, and I have worn these thick lace up ankle boots at times off and on for upwards of 35 years in all seasons. As regards our army ankle boot, there is a great deal of good about it. The thick hide leather used in the uppers is really better and less porous than the thinner hide leather used in gentlemen's uppers. It is both warmer and cooler than the thinner leather, and does not cling to the foot in a like manner, consequently admits of more ventilation. As far as I can see, one great difficulty is the fitting,² which requires care; and is not the advice of the Surgeon wanted to assist the officers of a company and the Quartermaster? If you want a walking ankle boot, put on the thickest socks you wear for your measurement, giving your largest foot. When you have done that show him where your feet are injured (sock removed), and if he is a man who understands his work he will soon give you ease and comfort. Now as to the one important point about the army ankle boot. Surgeon-Captain Beevor informed me that the army high-land shoes gave very few sore feet. On measuring this shoe, at Fimlico, I found it laced three-quarters of an inch lower than the army ankle boot of the same size, thus corroborating the experience I had gained in the agricultural labourer's low laced boot I had worn, and the want of which low lacing leads to a cause of "the soldier's sore foot." If you look at a pair of acrobat's boots, the lightest contrast to the ankle boot of the agricultural labourer, you will see they are low laced—and that is what we want in our army ankle boot, to lace three-quarters of an inch or one inch lower than they usually do. That is the strong point I wish to advocate, and that is the chief fault I could find, and is, I venture to say, also an anatomical one. May I add that for walking, and also for working men, all such boots as long, or jack boots and Wellington boots, must be condemned as being anatomically wrong, as there is no power to regulate the pressure between the instep and the heel? I would further suggest that the top lace hole should be

¹ In 1880, at Vienna, I saw that the low lacing ankle boot was worn by the Hungarian infantry (but not watertight), costing only 4 m. 50 p. Similar low lacing ankle boots are worn, I believe, in Hungary, and in parts of the Tyrol by the chamois hunters. The Hungarian infantry, I am informed, was considered specially good as to their marching power.

² Would not a manual as to fitting, &c., be of use to officers and men?

omitted so as not to tempt men to lace higher than just above the ankle bone. The laces (untanned) should be not less than 40 in. long (now 30 in.) so as to admit of going twice round just above the ankle bone. The lace should not be tight round the ankle, but should admit the full play of the foot both forward and backward, and also admit of ventilation to the foot. When laces are long enough, slacken, but do not unlace them. For hot weather on the march and manoeuvres the Newmarket strap, 1 ft. 4 in. long (as used by gentlemen when riding with trousers), might be used under the knee to support the trousers and allow of air circulating in and through the leggings.¹

¹ NOTE.—For services such as the Crimea, a certain number of agricultural labourers' watertight ankle boot should be issued (nailed as in army boot of winter issue) as being the easiest to fit and having better command over the vamp.

Table showing the Length of the Quarter and of the Vamp, also as to the Lacing Power and as to the Size of the Heels.

Name of ankle boot or shoe.	Size.	The length of the quarter round.	Length from the centre of the first lace-hole to toe of vamp.	Heel.		Lace-holes.			Remarks.
				Length.	Breadth.	Used.	Not used.	Total, one side.	
Army.	8	14½	6 to 5½	2½	2½	5	2	7	Does not lace low enough down on the instep by ½ in., or 1 in. would be better, like the gentleman's ankle boot.
Army Highland shoe.	8	15½	5	Do.	Do.	5	...	5	Surgeon-Captain Beevor says: "Mr. Blair, of Fimlico, reports he almost never has a complaint about these shoes."
Regulation pattern Volunteer (Wilkins and Denton).	8	15½	5½	2½	2½	6	2	8	
P. O. telegraph messengers.	8	15	5	3	2½	7	2	9	Say the best pattern as yet in the public service.
Gentleman's (West End make) walking ankle boot.	8	15	4½	2½	2½	7	1	8	
The English agricultural labourers' (watertights).	8	17 to 18	3½ to 3½	3	3	5	1	6	Village make Manufacturers } Say anatomically the most correct ankle boots.
	8	18				8	2	10	
Acrobat's boot.	...	...	3	No heel					
Bicyclist's and runner's shoe.	...	...	2½	3	3	7	...	7	For great activity, lace very low.
Elastic waisted shoe (Dowie).	...	...	4½	...	...	3	...	3	
For cricket, football, and all sports and games (Hickson and Sons).	...	...	...	...	...	...	...	...	The lacing is all low down the instep, say 4½ in.
Army Blucher, pattern 1868 (Fimlico), as used in the Crimea.	...	12	7	...	...	2	...	2	Say anatomically the worst ankle boot, fastening over the sinews instead of over the arch of the foot, consequently little grip for the heel.

Captain F. H. HOSKIER: I believe that with regard to sore feet, perspiration is at the bottom of the whole thing, and we ought to look upon marching as quite a special line apart from any other exercise. My own business keeps me on my feet most of the day, but it never induces perspiration as the exercise is not *continuous*, and I therefore never suffer from sore feet in my work, but on the march I have frequently suffered more or less in this way. I believe that comes from perspiration, and therefore I must vote for the shoe. They can be easily taken off and on, and in two minutes the perspiration can be relieved, and the soldier can go on and do more marching; it is the *continual* perspiration that spoils the whole thing, and causes sores and blisters on the feet. One speaker said he thought the boot ought to be used because it could be used everywhere, but I must say that I think boots should certainly be made for their own special work. We have the knack in the British army of making one thing do for all sorts of things. We have the general service wagon and we have the general service boot. I contend boots should be made for special work, and not that one boot should do duty for all sorts of work. The shoe at home, and the boot possibly in climates where it would be necessary, would be the best thing. Of course for a soldier's work some sort of spat or legging is necessary with a low shoe.

Surgeon-Captain BEEVOR: I would like to say a few words in reply to the various speakers who have been kind enough to take up the subject. Colonel Fergusson recommended a committee of experienced men—I presume he includes shoemakers and officers of the army—to sit and consider this subject. I fancy such a committee has sat before both in this country and abroad. I have searched the records a good deal on this subject, and in connection with that I would like to mention that upon the Continent a great deal more care is taken of the feet of the soldier than we do ourselves, and yet the Germans have really a very bad boot. If you notice the shape of the sole, it is almost straight. Of course it is quite correct, as one of the speakers pointed out, that there is a straight line existing between the heel and the ball of the great toe, but then this joint upon which the boot moves, if it does move at all, is an almost transverse one, and that is not right for the human foot. That is, undoubtedly, a bad boot to march in. Then, again, Dr. Eddowes, and also Surgeon-Captain Jackson, attributed the better marching of the Highland regiments chiefly to the source from which their recruits are taken. That may be so to a certain extent, but I fancy, gentlemen, you will agree with me, and I think Lord Methuen will also agree with me, that a great many men in the Highland regiments are not drawn from the Highlands. And if this is the explanation, then I maintain that it is a complement to my contention, because he avers that the Highlander is the best marcher, and why? Because he has generally worn the shoe; he has walked up and down the hills in shoes; he has not atrophied the muscles and tendons of his ankle like the agricultural labourer from Lancashire who is becoming undoubtedly flat footed. We are, from medical statistics, I know becoming a very much more flat-footed nation than we were, and it is chiefly because the sinews and muscles around the ankle are becoming atrophied from the boxing of our feet when we are young.

In connection with this I should like to mention the experience of an officer who is present, who was talking to me about the advantage of having freedom of the muscles and tendons of the ankle. He mentioned the case of an Anglo-Indian who shoots up in the Himalayas and the hills of India, and was with some of the regiments that were out in the hill campaigns. They discarded the boot altogether, and wore what they call "chupplies." Chupplies, I may say, are thin leather coverings of the feet in the shape of a sock, drawn over the foot or sock, and supported by a sort of sandal made generally of stout leather or dry grass. He found that the soldiers in India can march a great deal better with this covering than they can with the boot. He told me of his own experience only about two years ago when he went shooting up in the Himalayas, and said that when he returned back to the plains and tried to put on his old boots he found he could not, because the chupplies which he had been wearing had allowed his atrophied tendons and muscles of the foot to develop and become natural, and when he got back he found it difficult to enclose his natural foot which he had acquired in the hills in the former boot. Major Dashwood is perfectly right in saying that the

great advantages of the agriculturist's boot is, after all, that it laces well in front of the instep, and I wanted to show you that. You will see a sort of hollow in the diagram showing the exact spot on which a boot or shoe should lace. If the pressure of the lace is thrown in the oblique direction from heel to instep, you can fit the heel much better than if the lacing was *higher*. The lacing *high up* interferes with the movement of *that* tendon (diagram) in front of the ankle; running shoes, athletes' shoes, and so on, all lace very low down. They lace in front of the bone of the instep, and that would be a great improvement in our boot. This boot (the Regulation one) laces backward; it goes back instead of going forward, and this lacing interferes with the play of the sinews in front of the joint. Brigade-Surgeon Lieutenant-Colonel Myers was good enough to tell us about various experiences, and I quite agree with him that the old ammunition boot was an excellent one; but that was the hand-sewn one, and, undoubtedly, it was an excellent boot. I was in the campaign he mentions, with the artillery, and a great many of our men were supplied with these boots. They had to work very hard and lift enormous weights; it was a mule battery; they nearly all of them cut down the uppers of their boots altogether. As I told you, it is a fact that on parade you will find probably more than 90 per cent. of the soldiers do not lace their boots right up to the top: they leave two or three eyelets unlaced. These gunners could not be bothered with a piece of leather sticking out underneath their putties, and they cut the uppers of the boots right off. Now I find the artillery are supplied with a special equipment, approved and served out. In doing heavy work they find that they cannot have their feet confined, and when they have to lift heavy weights and so on, or move the guns, *this*, a sort of sandal, is supplied to the artillery. They prefer *this* to any of these hard boots. The ammunition boot supplied to the army is lined with sheepskin which, when wet, becomes stretched to an enormous extent, and then dries and cracks, and forms dreadful nodules inside the boot.

The CHAIRMAN (Lord Methuen): Ladies and Gentlemen, you will agree with me, I am sure, that we have had an interesting lecture on an interesting subject. I am one of those who, whilst admitting that our foot gear is not perfect, still think we are to some extent responsible for the fact that our men do not always march as well as they should. I think it is a matter of regret that we do not accustom our men to march with heavy weights on them, as much as they used to do in the old days. The corps that marched best in the German Army in 1870 was the Third Army Corps. The reason was because Prince Friedrich Carl, when he took over the command of that corps, made the men always in peace-time wear valises from the commencement of the drill season until the end, and as the year grew on, and the heat of August came, so the weight increased on the men's backs. They were, therefore, accustomed to marching long distances with heavy weights on their backs; their skin became hard, and, therefore, few men fell out during the march. With regard to the statement that men are flat-footed in the mining districts and so on, a remark was made to me by a retired officer which bears this out, or, perhaps, tends to show men require instruction in how to walk. He said to me, "In a night march during the 1892 Manœuvres, I could always tell such and such a regiment which recruits from a manufacturing town; you could hear them marching along the road with their soles catching against the ground." A regiment marching like that it stands to reason will not hold its own with a regiment that has been taught to march, or in which the men come from a part of England where the feet were properly formed for walking. With regard to the boot the navy wears, if I had to do the work of a navy, or if I had to be working where there is a great deal of mud, I should wear precisely the shape I see in front of me. If, on the contrary, I have to use a boot for walking purposes, I should use one like the ammunition boot, only made to a better pattern and of better tanned leather. I do not agree with the statement of the lecturer that a shoe is preferable to a boot. I see very few disadvantages in a boot, and I know that the shoe will admit both dust and wet; and you will agree with me in a campaign that this is not desirable. There is another matter which we have to remember as affecting the march. The lecturer referred to a march of 23 miles in which several men fell out. Now with regard to marching there is a golden rule: "March from night into day, do not march from day into

night." You have to study the hour at which you are to march, and if you have a march of 23 miles, and start early, you will find you will be less likely to fatigue your men than if you start later in the heat of the day. These are facts which we learn by experience, and it is extremely difficult without that experience to know the hour at which you should start. I have myself at manoeuvres seen the two faults committed of starting both too early and too late. With regard to the question of gaiters, I set very little weight upon that. I do not think that the short trouser would be at all an advisable or practical expedient, I think very little harm would really come from putting the trouser inside the gaiter (tuck up the trouser outside the gaiter, if you like, on the march), for I think that any officers here who have been through the manoeuvres, and have seen the way men have suffered at the commencement, will agree with me that trousers inside gaiters have very little to do with sore feet. The lecturer also remarks that he has seen, when following a battalion, the men lifting their feet from their thigh, because their boots did not give their feet sufficient chance of movement. I cannot support that statement, though I do not say it is incorrect. I am bound to say when once the men are thoroughly fit, and their feet in good order, I have seen all our soldiers, both Line and Guard, stepping forward as well as ever I wish to see men march. I will conclude by saying, if company officers will take care that their men are properly socked and booted before they start for a march, if the officers by experience learn the proper time at which to march men, if commanding officers and Generals commanding districts use every endeavour to keep their men fit at that time of year when manoeuvres and drills are not going on, viz., during the winter, we need have little fear that our men will march indifferently, and we shall find that the boots are not quite so much to blame as we are sometimes apt to think they are.

A large number of exhibits were collected and shown, including examples from the Museum of the Institution of German Army boots and ankle boots; strong navy ankle boots, as worn on the works of the Manchester Ship Canal; light shoes with elastic waist (Messrs. Dowies'); the shoe and legging as suggested by Surgeon-Captain Beever; and several examples of present army ankle boots with defects. From Pimlico:—Sealed pattern of 1868—a Blucher ankle boot, as used in the Crimea; army ankle boots of present date. From Messrs. Wilkins and Denton, contractors to H.M. Government:—Boots as made for the army, navy, volunteers, P.O. telegraph messengers, sandals to wear over ankle boots when working heavy guns, and navy tights. From Messrs. Hickson and Sons, wholesale manufacturers:—Cricket boots and shoes, football, golf, and hockey boots, runner's shoes, cycle riding and racing shoes, and army highland shoes for hot climates. These specimens all showed lacing 1 in. or more lower than the present army ankle boot. From Messrs. Barnet and Co., theatrical manufacturers:—Specimens of acrobat boot with very low lacing to embrace the tendons of the instep.

Sore Feet after Marches.

2ND SCOTS GUARDS.		CAMERONIANS.	
August 29	32 cases.	August 30	44 cases.
" 30	28 "	" 31	21 "
" 31	21 "	September 1	10 "
September 1	11 "	" 2	5 "
" 2	0 "		

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OCCASIONAL PAPER.

THE LOSS OF HORSES IN WAR.¹

By Veterinary-Captain F. SMITH, F.R.C.V.S., F.I.C., Army Veterinary Department.

WE hear very little about the loss of horses in war, and yet, as I shall have to show, it is a serious military and financial consideration.

The losses in campaigning may be divided into two classes, preventable and non-preventable; as classes these are perfectly distinct, though here and there they overlap in such a way as to be nearly indistinguishable.

The preventable losses amongst the horses of an army in the field are starvation, sore backs, stampedes, board-a-ship injuries, and certain diseases which arise from bad management. The non-preventable are losses arising from indifferent or imperfectly prepared food, losses accelerated by weather, viz., heat, cold, and rain: losses caused by the fire of the enemy, by exhaustion following on prolonged military operations and retreats, and those caused by disease.

The object of this paper is to deal with those causes of loss which have not been fully brought home to us. I allude to losses under fire, losses during retreats, from starvation, defective shoeing, sore backs, exhaustion, transport by sea, and stampedes. We shall then briefly review the entire causes of loss to an army in the field, and endeavour to ascertain what we must be prepared to meet in the future.

The literature of my subject is very scattered, and often scanty; the losses under fire are generally given in the official despatches; but all other sources of loss are rarely alluded to. Take the important question of sore backs: only one paper, so far as I am aware, has been published on the subject of the inefficiency and loss occasioned by these during war;² and it is only since 1879 that we have had any exact knowledge of the numbers which have occurred in our campaigns. Even the Germans, in spite of their methodical habits and complete official information, make no mention, either in the 1886 or 1870-71 campaigns, of the losses which they sustained from sore backs alone. Of the other causes of loss, two papers have been published on the losses of horses under fire in the Campaign of

¹ A brief summary of this paper appeared in the "United Service Magazine," August, 1893.

² "Sore Backs among Army Horses." I.V.S. (now V.-Colonel) James Lambert, A.V.D. "Veterinary Journal," March, 1881.

1870-71; they are based on the official German returns: one on the loss of artillery horses was published in the "*Revue Militaire de l'Étranger*," 1872,¹ and the other on the loss of cavalry horses appeared in the "*Revue de Cavalerie*," 1887. Finally, in this journal was published a lecture on "Casualties in the Field amongst Horses," dealing more particularly with our recent campaigns.² With these exceptions, I know of no other papers dealing with the loss of horses in war.

The information I have collected of losses under fire is very largely supplied from the regimental records of our cavalry. The student of history cannot help but regret that the majority of these regiments have lost half a century of their history through these records not being kept up to date.

My other sources of information are acknowledged elsewhere; though these references give no idea of the immense amount of material which has had to be worked through to obtain even the incomplete information which I purpose detailing.

LOSSES OF HORSES IN ACTION.

Apart from the importance attached to knowing what the probable losses of cavalry and artillery horses will be in action, it is interesting to note the relative frequency with which men and horses are hit. I shall have to show that the number of horses killed and wounded, as a rule, exceeds that of the men; this is especially the case with artillery, but the difference in numbers is less in cavalry, though there are many noteworthy exceptions.

A horse offers a much larger target than a man, and he presents this large surface at some little height above the ground. Observations on men show how much more frequent injuries of the upper half of the body are, compared with those of the lower half: in this respect the horse decidedly labours under a disadvantage, for his large surface corresponds in height with the upper half of man, and a larger proportion of hits are consequently received. I shall have to show in dealing with artillery horses, especially those of the Franco-German War, that the large target represented by the horses of a battery produces, in some cases, an enormous increase in the injuries inflicted on the quadruped as compared with the biped. The same thing, though not so marked, holds good for cavalry, excepting when exposed to a severe and concentrated fire as in a charge, or in the injuries resulting from hand-to-hand fighting; here, as we might suppose, the number of casualties amongst men and horses more closely approaches each other.

The earliest records of losses that I have met with are those at the battle of Aghrim in Ireland in 1691; the records are of two regiments only, but are interesting as giving us some notion that short-range

¹ Translated by Major (now Colonel) Hime, in the "*Proceedings of the Royal Artillery Institution*," 1874.

² "The Casualties among Army Horses in the Field." I.V.S. (now V.-Lieut.-Colonel) W. B. Walters, A.V.D.

artillery and protective body armour did not render fighting in those days anything but a serious business. These two regiments charged the rebels, and it is probable that in this way the majority of the losses occurred.

Battle of Aghrim.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
72	26	0	35	24	0
Total, 98.			Total, 59.		

Battle of Blenheim.

No records of the losses of men are obtainable, but the losses of horses of three cavalry regiments are given as 189 killed, wounded, and missing, of which the 6th Dragoon Guards lost 86. This regiment was charged by 7 squadrons of French cavalry, which they overthrew. It is unfortunate that nothing further of the losses at this great battle can be given, especially as the 5,000 cavalry on the field took such a prominent part in the fight.

Battle of Dumblain (Sheriffmuir).

The complete cavalry losses at this battle are given; there was severe hand-to-hand fighting with the rebels, which probably accounts for the greater equality in the loss of men and horses. Five regiments were engaged.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
36	61	0	36	75	0
Total, 97.			Total, 111.		

The heaviest loss fell on the then 4th Dragoons, with 20 men and 13 horses killed, 33 men and 44 horses wounded.

Battle of Dettingen.

Returns for 9 regiments are given, the following being the losses:—

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
108	205	0	336	147	0
Total, 313.			Total, 483.		

The loss of horses is here excessive, the cavalry was exposed to a heavy artillery fire, especially the present 3rd Hussars, which lost 42 men and 141 horses killed, 106 men and 50 horses wounded. Severe hand-to-hand fighting also occurred with the French cavalry; but in every regiment the loss of horses greatly exceeded that of the men.

Battle of Fontenoy.

Returns for 8 regiments are available.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
87	199	25	337	259	39
Total, 301.			Total, 635.		

The loss in men is nearly the same as at Dettingen; but the loss in horses very much greater. The Blues and Royals suffered the heaviest losses, both in men and horses. The cavalry was exposed to a heavy artillery and infantry fire, but there is nothing to show why the losses should have been so disproportionate.

Surprise at Melle.

The present 4th Hussars on its way to Ghent, in 1745, was surprised by 2 French batteries and 15,000 men. Only 35 men escaped unhurt, and 255 horses were killed.

Battle of Culloden.

Returns from 1 regiment only: it lost 3 men and 4 horses killed, 3 men and 15 horses wounded.

Battle of Val.

Returns from 2 regiments.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
175	96	0	229	43	0
Total, 271.			Total, 272.		

The losses here, between men and horses, are remarkably equal. There was very heavy hand-to-hand fighting, and both cavalry and infantry were charged. The Greys lost 101 men and 131 horses killed, 54 men and 21 horses wounded.

Battle of Warbourg.

Returns of 5 regiments.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
18	35	8	45	50	14
Total, 61.			Total, 109.		

At Warbourg the cavalry brigade had to traverse 5 miles of rugged country at a fast pace before they arrived at the field; they formed and charged at once.

There is still a great disproportion between the loss of men and horses.

Skirmish at Corbach.

The 3rd Dragoon Guards charged the French infantry. The regiment lost—

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
35	1	0	34	2	0
Total, 36.			Total, 36.		

The loss of men and horses was here identical.

Affair at Emsdorf.

The present 15th Hussars, 600 strong, routed a French force of upwards of 4,000 men, and took 2,000 prisoners. The following were their losses:—

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
75	50	0	116	52	0
Total, 125.			Total, 168.		

Battle of Camper.

Returns from 2 regiments engaged in an unsuccessful charge against the French. The losses are curious.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
7	12	34	37	8	12
Total, 53.			Total, 57.		

In this fight the missing men nearly balance the horses killed; the former evidently depended on the latter.

Skirmish at Zierenberg.

This was a successful night attack on the French; 2 squadrons of the Greys were engaged, with other regiments; their losses were 5 men, 9 horses killed, 7 men and 20 horses wounded. The excess of wounded horses is due to the larger target they afford, and perhaps to their colour, for at eight o'clock, on a September night, no individual aiming could have taken place.

Battle of Cateau.

6 Austrian and 12 English squadrons attacked a column of French infantry; 2,000 were cut down, 22 guns, 29 ammunition wagons, 136 horses, and 278 men taken prisoners. The British cavalry loss was—

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
56	100	6	133	91	67
Total, 162.			Total, 291.		

The losses indicate the severity of the fighting, but are very small for the magnificent results. The heaviest loss fell on the Blues: 16 men and 25 horses killed, 20 men and 17 horses wounded, 8 horses missing.

In the Memoirs of Viscount Combermere, who was present at this battle, it is stated that the cavalry charged unshaken infantry, and to rout them had to pass over a field of rape ploughed with very deep furrows; many of the horses fell in consequence. This may account for the number missing.

Battle of Tournay.

Returns of 9 regiments which charged the French infantry.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
58	81	4	116	104	9
Total, 143.			Total, 229.		

In this and the previous battle there was a great difference between the loss of horses and men.

Battle of Bergen.

From the "London Gazette" of this year is obtained the losses of the three cavalry regiments engaged and also of the artillery. This is the earliest record I can obtain of the losses of artillery horses in action.¹

<i>Cavalry.</i>					
Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
5	25	0	10	32	3
Total, 30.			Total, 45.		
<i>Artillery.</i>					
9	66	0	34	45	0
Total, 75.			Total, 79.		

Battle of Ross.

This battle took place in the Irish Rebellion of 1798.

¹ Table quoted by Whynates, "From Corunna to Sebastopol."

Artillery.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
2	4	13	20	4	1
Total, 19.			Total, 25.		

Other Corps Cavalry (?)

Cavalry and infantry are mixed up in this table.	54	5	4
	Total, 63.		

Affair at Villers-en-Couchée.

Two regiments return losses for this fight, though history accords to 2 squadrons of the 15th Hussars, and 2 squadrons of Austrian cavalry the glory of having broken a French square, killed 900 men, and made 400 men prisoners, together with 5 guns. The strength of the allied squadrons was 270. The following were their losses:—

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
21	19	10	26	22	11
Total, 50.			Total, 59.		

The influence of hand-to-hand fighting where the man is the foe, and not the horse, is here well seen by the closeness of the respective losses, that of the men being 18·5 per cent., and of the horses 21·8 per cent.

The 1st Dragoon Guards return a loss for the above affair—

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
7	0	23	29	0	64

Affair at Roubaix.

Both men and horses must be difficult to hit in moments of intense excitement. In the above disgraceful affair, when part of the army stampeded through the narrow street of a village, ran a perfect gauntlet of fire, and eventually fell over one another in a mass of hideous confusion, the losses of 1 regiment only amounted to 6 men, 9 horses killed, 15 men, 9 horses wounded, 2 men, 18 horses missing.

Peninsula.

With one or two exceptions the battles in the Peninsula did not include cavalry fights, though in some of the numerous skirmishes rather heavy losses were inflicted. The losses resulting from the retreat on Corunna will be dealt with under "Retreats."

Salamanca.

A French infantry division was cut to pieces in this battle by a charge of British cavalry and lost 3,000 men; in another part of the field a cavalry charge resulted in 2,000 prisoners and 5 guns being captured in a few minutes. The present 4th Hussars suffered the heaviest loss, and as they have not distinguished between the killed and wounded, but simply given their totals, the returns from the other regiment engaged are shown by me in the same manner. The total loss of men was 75, and of horses 131. The loss of horses was nearly double that of the men.

Combat at Garcia Hernandez.

Fought the day after Salamanca by the cavalry of the King's German Legion, who charged and broke three squares of French infantry, and made 1,400 men prisoners. The French General Foy said that he regarded this as the most brilliant and decisive charge of the whole war. The loss of the German brigade was as follows:—

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
52	58	6	67	46	4
Total, 116.			Total, 117.		

The relative proportion of men and horses in severe close fighting here comes out in the most striking manner; the musketry fire to which this devoted brigade was exposed was terrific.

Battle of Talavera.

A singular accident happened to the cavalry at this battle through the ground not being reconnoitred over which they were to charge, and by which the 23rd Light Dragoons were precipitated into a ravine. It is strange how history repeats itself. An identical accident, and from the same cause, occurred to a regiment of Prussian cavalry at the Battle of Koeniggratz in 1866.

Brigaded with the 23rd Light Dragoons at Talavera was the 1st Regiment of Hussars, King's German Legion; the two regiments were ordered to charge the French infantry. Just as the charge commenced the brigade came on the ravine, the foremost horseman rode headlong into it, and a frightful scene ensued. The hussars suffered less than the dragoons. The charge was useless, and, to add to the disorder, the French artillery swept their ranks. Here are the losses of the brigade:—

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
50	84	110	102	52	134
Total, 244.			Total, 288.		

The remaining cavalry losses at the same battle were:—

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
12	29	2	53	13	23
Total, 43.			Total, 89.		

The increase in the loss of horses is doubtless due to artillery fire.

We are also able to give the artillery losses at Talavera; this for the men was 66, and for the horses 40. This great difference between men and horses in artillery is quite exceptional in later battles.

Battle of Albuera.

Artillery Losses.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
3	28	41	33	10	34
Total, 72.			Total, 77.		

The small difference in the losses is here accounted for by the large number of missing. There were only 31 men killed and wounded against 43 horses.

Cavalry Losses.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
13	30	5	21	16	6
Total, 48.			Total, 43.		

The heaviest loss was in the present 4th Hussars in hand-to-hand fighting with the Polish lancers.

Battle of Vimiera.

Artillery.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
2	2	0	0	2	0

Cavalry.

20	24	11	30	10	1
Total, 55.			Total, 41.		

The cavalry loss was limited to 1 regiment—the 20th Light Dragoons.

Battle of Almeida.

Artillery.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
0	0	2	2	2	0

Cavalry.

1	6	0	1	10	0
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*Fuentes d'Onor.**Artillery Losses.*

Men.		Horses.	
Killed.	Wounded.	Killed.	Wounded.
6	22	12	24

I have quoted these losses owing to Norman Ramsay's gallant exploit; what his exact loss was when his troop of horse artillery cut its way through the French cavalry we do not know; it must have been only trifling, for the total horse artillery loss for the day amounted to 1 man and 3 horses killed, 1 man and 3 horses wounded.

The only battle where I have been able to obtain a detailed return of the French losses, in spite of their numerous and brilliant campaigns, is that for the battle of Fuentes d'Onor. It is given in the "*Mémoires de Masséna*."

The artillery lost 20 horses.
 Montbrun's cavalry 246 ..

The strength of the latter was 2,150; the loss, therefore, equalled 11·4 per cent.

Skirmishes.

I have collected the records of 15 skirmishes which took place in the Peninsular War. As we may regard these, in the majority of cases, as consisting of fighting at close quarters and actual personal combats, the results are interesting.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
97	225	35	151	161	70
Total, 357.			Total, 382.		

The figures closely approximate and indicate close fighting.

Two skirmishes stand out very prominently in the way of losses.

At Cellada del Camino two regiments lost 116 men and 106 horses; and at Castrillos, where there was sharp hand-to-hand fighting, the present 14th Hussars lost 55 men and 38 horses. At Benavente the 3rd Hussars, King's German Legion, lost 46 men and 69 horses killed and wounded.

*Quatre Bras.**Artillery Losses.*

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
9	19	0	19	14	1

Cavalry Losses during the Retreat from Quatre Bras to Waterloo.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
20	41	19	45	20	30
Total, 80.			Total, 95.		

Ligny.

The only Prussian losses I can find refer to a battery of artillery which lost 19 men and 53 horses.

BATTLE OF WATERLOO.

Very complete returns are obtainable for this battle, not only for the British troops, but also for the Allies.¹

British Artillery.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
57	235	10	337	123	35

Artillery, King's German Legion.

20	57	4	51	0	0
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Dutch-Belgian Artillery.

28	116	30	175	6	15
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Prussian Artillery.

15	66	9	58	44	0
120	474	53	621	173	40

Total, 647.

Total, 834.

This battle demonstrates the great excess of loss amongst the horses, especially that of the British. G Troop, British artillery suffered the heaviest loss both in horses and men, and Mercer (the commanding officer of the troop) has placed on record, in his interesting "Journal of the Waterloo Campaign," the disastrous effect of the French fire on his battery. Of 200 horses which went into action, 140 were killed or wounded.

Mercer was not wounded, though his horse was hit in eight places. Marshal Ney had five horses killed under him, but he escaped unhurt.

Mercer records that one-third of his men were killed; his account of the desolation produced in a battery under heavy fire for hours is terrible: his description of the behaviour of the mortally wounded horses is strikingly real, showing his great power of observation.

¹ "History of the Waterloo Campaign." Siborne.

*Cavalry Losses at Waterloo.**British Cavalry.*

Men.			Horses		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
567	1,046	409	982	596	673

Cavalry, King's German Legion.

98	258	12	194	144	54
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Dutch-Belgian Cavalry.

163	614	452	549	0 ¹	884
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Prussian Cavalry.

40	327	94	248	324	90
868	2,245	967	1,973	1,064	1,701

Total, 4,080.

Total, 4,738.

This cavalry loss is equal to 32.5 per cent. of the men killed, wounded, or missing, and of the horses 38 per cent.

In no other battle, until we come to Vionville-Mars-la-Tour, have we such an opportunity for studying the effect of severe hand-to-hand fighting, and fighting at close quarters with infantry, as at Waterloo. The regimental losses are, therefore, most instructive.

The celebrated charges of the Heavy Brigade and Union Brigade were only accomplished by very heavy losses; the former was directed against the French Cuirassiers, the latter against the French infantry, ultimately both brigades against the artillery, and, lastly, they had to defend themselves in an exhausted condition against a body of cavalry.

Loss of the Heavy Brigade.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
95	248	250	248	69	355
Total, 593.			Total, 672.		

Loss of the Union Brigade.

264	310	38	445	131	55
Total, 612.			Total, 631.		

The Greys lost the largest number of men killed, 102, and the largest number of horses, 179. The Inniskillings had the largest number of men and horses wounded, viz., 116 and 49 respectively;

¹ No wounded horses shown in the return.

whilst the King's Dragoon Guards had the largest number of men and horses missing, viz., 128 and 243.

The result of these charges was the destruction of 5,000 infantry, 3,000 prisoners taken, and 40 guns rendered useless.

The loss of the brigade was as follows:—

	Men.	Horses.
Heavy Brigade	48·36 per cent.	54·8 per cent.
Union " 	51·8 "	53·4 "

Napoleon's Losses.

Napoleon's losses amongst horses under fire I have not been able to trace; it is said that at Marengo Kellermann's brigade was 470 horses strong before the battle, and only 150 horses remained at the end of the day. In a life of Kellermann, published in the "*Revue de Cavalerie*," it is stated that at Marengo the heavy cavalry was reduced from 800 horses to less than 300.

At Eylau the losses on both sides were terrific owing, as Alison says, "to the extraordinary quantity of cannon balls discharged at close proximity to the contending masses." This authority² says that 6,000 horses were killed or wounded, and his description of the winter battlefield is very painful.

At Fuentes d'Onor Massena³ put the French loss of horses killed at 246 for the cavalry of Montbrun, and 20 for the artillery. The strength of the cavalry before the battle was 2,150 horses; no mention is made of the number wounded.

It is possible, however, to get at Napoleon's losses indirectly. General Bourcier had charge of the remounting of the Grande Armée at Potsdam, and in a letter to the Emperor, dated 1806, he said that the number of wounded horses at Potsdam was astounding—2,347 out of a total of 3,807; and a return furnished of the small regimental dépôts stationed at the same place shows that out of 742 horses, no less than 429 were sick and wounded.⁴

There is no mention of the cause of the wounds, but I take it that they refer to those received in action, and wounds from the saddle.

Battles in India.

Turning now to some of the battles in India, we find that the united losses at Mehidpoor, Leswarree, Ferruckabad, and Siege of Bhurtpoore, amounted for the cavalry to

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
31	92	0	118	63	53
Total, 123.			Total, 234.		

The artillery losses at Mehidpoor were 20 men and 45 horses.

¹ March, 1887.

² "*History of Europe*," vol. ii.

³ Koch's "*Mémoires de Masséna*."

⁴ "*Revue de Cavalerie*," 1893.

The losses in the Afghan campaign of 1839 were heavy, but this was not due to the enemy, and the figures will be quoted later.

In the Sikh campaigns of 1845-46 the losses were very heavy.

Battle of Moodkee.

Artillery.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
27	49	0	45	25	0
Total, 76.			Total, 70.		

Cavalry.

91	87	0	165	63	0
Total, 178.			Total, 228.		

In this battle fewer artillery horses were killed than men, which is very exceptional. The cavalry loss was heavy, and principally occurred to the present 3rd Hussars, who with a strength of 518 charged a force said to consist of 30,000 infantry and cavalry. The enemy was put to flight and pursued. The loss of the 3rd Hussars was 60 men and 105 horses killed, 37 men and 23 horses wounded.

Battle of Ferozeshah.

Artillery.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
41	69	0	118	79	0
Total, 110.			Total, 197.		

Cavalry.

83	142	0	271	114	0
Total, 225.			Total, 385.		

The loss of horses is here greater both in artillery and cavalry. The brunt of the action again fell on the 3rd Hussars, who charged the Sikh guns in magnificent style, and rode through the enemy's camp. The loss of the regiment was 55 men and 107 horses killed, 93 men and 60 horses wounded.

Battle of Aliwal.

Artillery.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
3	15	5	30	9	12
Total, 23.			Total, 51.		

Cavalry.

96	146	0	145	70	85
Total, 242.			Total, 300.		

The loss of horses is greater than men in both artillery and cavalry, 23 men and 51 horses in the artillery, 242 men and 300 horses in the cavalry. The chief loss occurred to the 16th Lancers. This regiment charged the Sikh artillery; desperate hand-to-hand fighting occurred with the infantry, which was broken and driven into the Sutlej. The 16th Lancers had 58 men and 77 horses killed, 83 men and 22 horses wounded, 1 man and 73 horses missing.

*Battle of Sobraon.**Artillery.*

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
7	45	0	17	23	5
Total, 52.			Total, 45.		

Cavalry.

6	38	0	13	50	24
Total, 44.			Total, 87.		

*Operations around Delhi from 30th May to 20th September, 1857.**Artillery.*

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
74	289	4	54	62	4
Total, 367.			Total, 120.		

Cavalry.

46	77	0	55	57	36
Total, 123.			Total, 148.		

The excess of men killed and wounded over horses in the artillery is explained by the siege.

CRIMEAN CAMPAIGN.

The loss of horses in this campaign was very severe, not, however, at the hands of the enemy, but from other causes, which have yet to be dealt with.

The loss of horses killed in action, excepting at Balaclava, was insignificant.

*Battle of the Alma.**Artillery Losses.*

Men.		Horses.	
Killed.	Wounded.	Killed.	Wounded.
12	21	26	0
Total, 33.		Total, 26.	

*Battle of Balaklava.**Heavy Cavalry Losses.*

Men.		Horses.	
Killed.	Wounded.	Killed.	Wounded.
9	97	46	68
Total, 106.		Total, 114.	

A great discrepancy occurs in various works dealing with this battle, as to both the heavy and light cavalry losses. The losses of men I have taken from the official returns, the loss of horses from the evidence given by Lord Lucan before the Chelsea Commissioners. It must be remarked that the above losses do not represent those which occurred in the charge; all eye-witnesses are unanimous that our losses were trifling. Kinglake says 78 men killed and wounded; Russell says 35 killed and wounded, of which 4 or 5 were killed outright; Calthorpe puts the casualties at barely 20. The Russian losses are variously stated from 200 to 500, but it is certain that the chief loss they suffered was not received at the hands of our cavalry, but from C Troop, R.H.A., which fired, according to Whynates, 49 shot and shell after them in their retreat, at a comparatively short range, and made "splendid practice."

The trifling losses of the Heavy Brigade in the charge were considerably augmented by the artillery fire to which they were exposed in covering the retreat of the light cavalry, and there can be no doubt that most of the killed and wounded in the above table are thus accounted for.

Light Cavalry Losses.

It is equally difficult to obtain accurate figures for the light cavalry losses. I have selected those obtained from official returns published at the time, from information supplied by the regiments concerned. These are also quoted by Whynates, who, after careful investigation, considers them reliable.

On the morning of Balaklava the Light Brigade had on parade 658 horses, including officers. They lost in the charge—

Men, 277.

Horses, 362.

or, on the total strength, a loss of men equivalent to 40·57 per cent., and of horses, 50 per cent. This is not quite so severe as the loss of the Heavy Brigade at Waterloo. Lord Lucan put the loss of horses at 300; Kinglake put it at 475, including 43 shot for wounds, and 42 others wounded. Russell put it as 394 killed, and 126 wounded. The number quoted above is from the regimental records, and should be correct.

French Cavalry Losses.

In the gallant charge made by 200 French Chasseurs d'Afrique at Balaklava, they lost—

¹ "From Corunna to Sebastopol."

Men.		Horses.	
Killed.	Wounded.	Killed.	Wounded.
13	7	16	12
Total, 20.		Total, 28.	

Artillery Losses.

The artillery lost in the battles of the Alma, Balaclava, and Inkerman, 96 horses killed in action or died from wounds.

AMERICAN CIVIL WAR.

The literature of this war is enormous, and it has been difficult, from the seventy odd official volumes published up to date, to obtain any connected account of the loss of horses. I have therefore only selected one or two cases where the losses are clearly tabulated.

*Battle of Gettysburg.**Artillery Losses of the 3rd Corps.*

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Captured.	Missing.
17	111	29	190	50	187
Total, 157.			Total, 427.		

Cavalry (FitzLee's Brigade).

3	33	27	15	Wounded. 14	0
Total, 63.			Total, 29.		

Artillery, Army of the Potomac.

Total loss, 737.

Total loss, 881.

Cavalry (6th Virginia Regiment).

Total loss, 298.

Total loss, 292.

Battle of Fleetwood.

In the fight at Kelly's Ford, General Lee reports the following loss amongst Stuart's cavalry:—

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
11	88	34	71	87	12
Total, 133.			Total, 170.		

Expedition to Tupelo, Miss.

Three cavalry regiments marched 350 miles; there was but little forage or water, which probably accounts for the missing.

THE LOSS OF HORSES IN WAR.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
2	32	3	19	32	40
Total, 37.			Total, 91.		

*Battle of Atlanta.**Co. F.U.S. Artillery.*

Lost, 2 men killed and 23 wounded. Horses, 103 killed.

Battle of Belmont.

One battery at this action lost 45 horses killed, and all but 1 wounded. Loss of men not stated.

*Battle of Chickamauga.**Artillery Losses.*

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
51	223	29	309	97	0
Total, 303.			Total, 406.		

AUSTRIAN WAR, 1866.

I have only been able to obtain returns from one battle, and these unfortunately give only the total losses, and no details.

*Battle of Koeniggratz.**Prussian Artillery Losses.*

Men, 314.

Horses, 307.

In this battle we meet with an important exception to the rule that more artillery horses are killed than men, and it is difficult to see the reason why this should have been the case at Koeniggratz. An Austrian battery captured by the Prussians lost 54 men and 58 horses; a second captured battery lost 27 men and 41 horses in one position.

The cavalry losses are interesting, though very incomplete. At the termination of the battle and during the pursuit there were some sharp cavalry encounters.

Prussian Cavalry Losses.

Men, 615.

Horses, 536.

The Prussians lost more men than horses, which is very exceptional.

Austrian Cavalry Losses.

These were fearfully heavy, illustrating the deadly effect of breech-loading rifles. The Austrian losses are given in detail.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
317	348	314	1,055	235	850
Total, 979.			Total, 2,140.		

These severe losses were doubtless intensified by the subsequent retreat of the army. It is important to note that there were more than two horses lost for every man.

I have previously alluded to the incident of one Prussian regiment charging into a ravine, as at Talavera. Unfortunately the losses at the ravine are not clearly given, the table showing a regimental loss of 201 men and 87 horses, but the number of casualties which occurred at the ravine and in the subsequent charges are not separated.

Associated with the above regiment in the most important cavalry encounter of the day were two Prussian light regiments. They were attacked by two Austrian Cuirassier regiments; the Prussians lost 86 men and 99 horses; the two regiments of Cuirassiers lost 317 men, but the loss of horses is not stated.

Hozier has made us familiar with the cavalry encounters which took place during the retreat, when the heavy Prussians always rode down the light Austrians.

At Vorkloster both parties met on a bridge, and eventually the Austrians were driven back, after a stubborn resistance.

The Austrians lost 54 men, and 30 horses killed, wounded, and prisoners. The Prussians lost 2 men killed, 18 men wounded, and 3 horses missing. The value of this table is destroyed, so far as the Austrians are concerned, by including the prisoners with the killed and wounded.

The Saxon and Prussian cavalry came into collision during the retreat, and there was severe hand-to-hand fighting. The Prussians lost 2 men killed, 20 wounded, 25 horses disabled. The Saxons lost 19 men and 13 horses killed and wounded.

Actions of Tobitschau and Rokeinitz.

At Tobitschau the 5th Regiment of Prussian Cuirassiers, led by von Bredow, charged some artillery, and beat back their cavalry supports. The Cuirassiers captured 18 guns, 15 limbers, 7 ammunition wagons, 400 prisoners, and 157 horses. Their loss was 12 horses killed, 10 men and 3 horses wounded and missing.

At Rokeinitz a squadron of the 10th Uhlans charged a body of Austrian infantry and rode them down; the squadron lost 3 men and 12 horses killed, 2 men and 8 horses wounded.

Some remarkable cavalry fighting occurred in this action; the Austrians received one charge at the halt, and obstinate hand-to-hand fighting occurred.

Cavalry Loss at Tobitschau and Rokeinitz.

	Men.		Horses.	
	Killed.	Wounded.	Killed.	Wounded.
1st Cuirassiers.....	0	9	9	2
5th „	0	10	12	3
4th squadron 10th Lancers	3	3	12	8
2nd squadron 2nd Hussars	4	8	8	3
2nd Landwehr	3	57	7	39
	10	87	48	55
	Total, 97.		Total, 103.	

There is an extraordinary disproportion between the men killed and the horses killed: of course many of the latter are horses which have had to be destroyed on account of the severity of their wounds; still the numbers are disproportionate. The totals, on the other hand, agree for close fighting.

In the action of Hundheim the 8th Prussian Hussars drove a Baden dragoon regiment through the streets of Walldürn, hand-to-hand fighting ensued, in which the Baden dragoons lost 2 men killed, 31 men and 21 horses wounded and missing. The Prussian hussars had only a few men and horses wounded.

A Prussian dragoon regiment was fired on by some Bavarian infantry; the latter were ridden down; the dragoons lost 15 men wounded, 17 horses killed, and 27 wounded.

In the two last quoted cases we have a good example of hand-to-hand fighting, cavalry against cavalry and infantry operating on cavalry at short ranges. In cavalry *v.* cavalry the men are killed and not the horses, and the wounded men exceed the wounded horses; this is what we might expect, the man is the foe here and not the horse; on the other hand, the infantry aimed at the mass, and the larger target suffered the most.

I can obtain no other losses for the Austro-Italian campaign than those given below. The Italian losses were not given in the article consulted.¹

Battle of Custoza.

The brigade of Pulz lost—

Men, 378. Horses, 487.

One Austrian uhlan regiment lost—

Men, 86. Horses, 79.

FRANCO-GERMAN WAR, 1870.

The whole of the following losses refer to the German Army. There appear to have been no losses published by the French.

¹ "Revue de Cavalerie."

*Battle of Weissenburg.**Cavalry.*

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
3	7	3	12	5	13
Total, 13.			Total, 30.		
<i>Artillery.</i>					
1	18	3	10	28	8
Total, 22.			Total, 46.		

*Battle of Wörth.**Cavalry.*

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
14	44	2	35	16	0
Total, 60.			Total, 51.		
Artillery.					
13	123	1	107	118	0
Total, 137.			Total, 225.		

Of the cavalry losses in this battle some are very peculiar. The 14th Hussars lost 12 men killed and 18 wounded, but no horses suffered. The 13th Hussars lost 2 men and 20 horses killed, whilst 16 men and 15 horses were wounded.

It was at the battle of Wörth that Michel's Brigade, consisting of two cuirassier and one lancer regiment, charged the Prussian infantry over unreconnoitred ground through hop fields, and eventually passed into the village of Morsbroun. They were received with volley firing, and two-thirds of the leading regiment were hit and down before the village was reached; the other regiments got into the streets of Morsbroun, which were found to be barricaded. There was the most dreadful confusion; a heavy fire was poured on them from the houses, and all who were not killed were taken prisoners. The exact losses unfortunately are not given. The regimental history of the 1st Cuirassiers says that they lost 60 men, but this must be an under-estimate.

Later in the day of the same battle, Bonnemain's division charged the Prussian infantry. The charge was made by the 2nd Cuirassiers and one wing of the 3rd Cuirassiers. The ground was again unfavourable, and the regiments were decimated. These are the losses:—

2nd Cuirassiers	134 men, 250 horses.
3rd ,, 	77 ,, 70 ,,

Of the 2nd Cuirassiers 80 horses left on the field returned, but they were so badly wounded that they soon died; they are included in the above loss.

The loss of men in the 2nd Cuirassiers was 30 per cent., and of the horses 57 per cent.

The loss of men in the 3rd Cuirassiers was 32 per cent., and of the horses 35 per cent.

These percentages can only be approximate, as the exact numbers in the charge are not stated.

Battle of Spicheren.

Cavalry.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
6	38	1	23	51	2
Total, 45.			Total, 76.		

Artillery.

7	73	0	38	65	0
Total, 80.			Total, 103.		

Battle of Colombey-Neuilly.

Cavalry.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
5	20	0	14	27	0
Total, 25.			Total, 41.		

Artillery.

23	94	1	72	79	0
Total, 118.			Total, 151.		

In this battle a battery of Prussian artillery came into action 900 yds. from a semicircle of sharpshooters, supported by mitrailleuses and a battery firing shrapnel. The Prussians could only fire 28 rounds; the battery was totally shattered and had to retire. As an example of the loss inflicted on them it is mentioned that a gun without a limber was dragged away by one horse. The battery lost 15 men and 20 horses killed; 30 men and 34 horses wounded.

Battle of Vionville—Mars-la-Tour.

Cavalry.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
296	977	125	931	298	382
Total, 1,398.			Total, 1,611.		

Artillery.

172	555	1	688	324	3
Total, 728.			Total, 1,015.		

Of all the battles in this campaign this is the one which interests us the most for the heroic charges made by the cavalry resulting in the fearful loss we have given above. Nor were the devoted French cavalry a whit behind their enemy in courage and determination, the only difference between the two being that the French cavalry were uselessly sacrificed, whilst the annihilation of the German regiments was productive of most important results to their army.

French Cavalry Charge.

The Cuirassiers of the Guard—a total of 5 squadrons—charged two companies of the 52nd Prussian infantry, which did not fire until the enemy was within 250 paces. The cavalry parted to the right and left and rushed into more infantry behind. According to Bonie¹ the cavalry was thrown into disorder by an unforeseen obstacle, consisting of a baggage wagon and biscuit barrels. The steady fire of the Prussians annihilated the force. The French losses were 230 men and 243 horses, or, taking the strength at 330, a loss of 69·7 per cent. for the men and 73·6 per cent. for the horses. Such losses deserve to be spoken of as extermination.

Prussian Cavalry Charges.

Charge of the Brigade of Bredow.

Bredow's Brigade consisted of 6 squadrons, in all under 800 strong, composed of the 7th Cuirassiers and 16th Lancers. The object of the charge was to save time, for the Prussians were severely pressed and had no reserves. The brigade first charged the French batteries, then two divisions of infantry, riding over each; they were then attacked by the French cavalry and afterwards retired. It has been stated that during the advance over 1,500 yds. until the first infantry line was penetrated, not more than 50 horses fell. The number of infantry brought to bear on these devoted regiments was not less than 8,000. The actual length of the charge was 3,000 yds. These are the losses :—

7th Cuirassiers.....	196 men, 209 horses.
16th Lancers.....	183 „ 200 „
	<hr/>
	379 409

or a loss of 47 per cent. of the men and 51 per cent. of the horses.

The effect of the charge was to stop the advance of the 6th French Corps, and the pressure was removed from the 6th Prussian Infantry Division.

Charge of the Prussian Dragoons of the Guard.

This charge was made against infantry to save von Wedell's infantry brigade, which was being annihilated. Three squadrons

¹ Achievements of Cavalry, "United Service Magazine."

took part, having a strength of 426 sabres. They fell upon the 13th French Regiment of the Line and cut them up. The 3 squadrons lost 138 men and 216 horses, or a loss of 32·4 per cent. of the men and 50·7 per cent. of the horses.

The official account of the battle gives the loss as 132 men and 250 horses. Lieutenant-General Sir Evelyn Wood,¹ who has consulted the latest sources of information, gives the loss as 138 men and 216 horses, whilst the losses for the regiment for the whole day in the German official return are only put at 96 men and 204 horses. I cannot account for these discrepancies.

Grand Mêlée of Cavalry.

Immediately after the charges executed by the Prussian Guard Dragoons, a series of movements occurred which brought 7 regiments, or parts of regiments, into one long line, which immediately attacked a corresponding long line of French cavalry. 5,000 men were speedily engaged in hand-to-hand fighting, enveloped in a tremendous cloud of dust. The impact was terrific, and the French cavalry were soon put to flight. Bonie tells us that the French light cavalry were knocked to pieces against the solid, impassable line formed by the German dragoons, and, in speaking of the fight, gives us some notion of how completely the French had lost their presence of mind when they mistook their own lancers for uhlans and cut them down.

As no separate losses are given for this charge I extract those furnished by the regiments engaged. The losses represent the whole day of the battle and not this charge alone, though it is probable that the majority of the losses occurred here.

	Men.			Horses.		
	Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
2nd Dragoons of the Guard ² ...	15	95	11	105	45	0
13th Dragoons..	5	80	8	12	35	18
19th „ ..	14	102	9	0	0	95
4th Cuirassiers	12	33	3	50	0	6
13th Lancers ..	10	40	6	24	19	18
10th Hussars ..	3	26	4	10	13	15
16th Dragoons..	4	18	3	17	6	20
	63	394	44	218	118	172
	Total, 501.			Total, 508.		

As I have previously said, it is difficult to exactly apportion from these losses what share should fall to this charge; I think we might safely say two-thirds. It will be observed how closely the loss of

¹ "The French Cavalry in 1870." Colonel Bonie.

² One squadron of this regiment lost 70 horses in one of the isolated combats early in the battle, in charging the retiring battalions of two French brigades.

men and horses corresponds.¹ The regimental losses are interesting, especially those of the 19th Dragoons.

It has been said that the *mêlée* lasted half an hour! It is important to note that the Prussian cavalry had been in the saddle since 2 A.M., and had neither watered nor fed the whole day.

Here are the losses for the battle of Mars-la-Tour for the 3 cavalry divisions present, exclusive of the cavalry operating with infantry which are included in the first table given:—

	Men.	Horses.	Strength.
Guard Cavalry Division.	217 (18 p. c.)	354 (29 p. c.)	1,202
5th " 	852 (17 p. c.)	819 (16 p. c.)	5,029
6th " 	275 (9½ p. c.)	313 (10·8 p. c.)	2,883
	<hr/> 1,344	<hr/> 1,486	<hr/> 9,114

From this it will be seen that there is a fairly close parallel between the loss of men and horses in cavalry. Turning now to artillery we find no such parallel. The total loss of artillerymen was 728, whilst that of the horses was 1,015, and even this difference is not as great as might be expected, nor so large as occurred at Gravelotte, Sedan, and several minor engagements.

Respecting the loss of men and horses a curious coincidence occurred in this battle in 2 batteries of artillery.

	Men.			Horses.		
	Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
1st F. Div. 10th						
F. Art. Regt.	13	31	0	31	9	0
2nd ditto	13	31	0	32	11	0

The number of men and horses hit was nearly identical in each division, and had it been an experiment carefully performed closer results could hardly have been obtained.

Battle of Gravelotte.

Artillery Losses.

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
171	764	10	931	344	2
Total, 945.			Total, 1,277.		

The totals here are made up of actual killed and wounded, and not, as is so often in cavalry losses, with "Missing." Again we notice the great difference between the loss of men and horses.

In this latter respect the most notable artillery losses in this battle were:—

¹ In the "Revue de Cavalerie," April, 1887, the loss of men and horses amongst the Germans in the "Grand Mêlée" is quoted at 498 and 479 respectively, which compares very well with the table we have quoted. I think it is certain that the exact losses in the *mêlée* are not known.

	Men.		Horses.	
	Killed.	Wounded.	Killed.	Wounded.
1st F. D., 9th F. Art. Regt.	23	92	183	31
2nd F. D., 2nd H. A. Batt. 9th Art. Regt.	43	140	259	42
	66	232	442	73
	Total, 298.		Total, 515.	

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
30	132	2	99	155	28
Total, 164.			Total, 282.		

*Battle of Beaumont.**Artillery Losses.*

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
21	136	2	78	117	0
Total, 159.			Total, 195.		

Cavalry Losses.

3	10	0	16	11	2
Total, 13.			Total, 29.		

*Battle of Sedan.**Artillery Losses.*

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
46	301	0	346	288	3
Total, 347.			Total, 637.		

Cavalry Losses.

25	99	20	101	83	19
Total, 144.			Total, 203.		

The most notable of the German losses at this battle were the following:—

	Men.			Horses.		
	Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
3rd H. A. Div., 11th F. A. Regt.	9	52	0	105	39	0
	Total, 61.			Total, 144.		
Guard Cav. Div.	9	51	0	54	62	0
	Total, 60.			Total, 116.		

The cavalry charges executed at Sedan were principally French. It is melancholy to read of the useless manner in which this devoted branch was sacrificed. The only knowledge we have of their losses is on the testimony of Bonie, who states that on an average each regiment lost 250 horses, which we may take roughly at 50 per cent.

Later, in speaking of a charge executed by the 4th French Lancers, which were endeavouring to support the Chasseurs d'Afrique, we are told that the regiment lost two-thirds of their men and horses. One squadron of the 1st Regiment of French Cuirassiers, in endeavouring to cut their way through the Prussians, lost three-fourths of their number.

I do not propose dealing any further with the losses in the Franco-German War, excepting to draw attention to those suffered at the battle of Bapaume by the 8th Prussian Cuirassiers and a battery of field artillery.

Two squadrons of the 8th Cuirassiers charged a body of French infantry formed in square. The cavalry received the fire at close quarters. Their losses were:—

Men.			Horses.		
Killed.	Wounded.	Missing.	Killed.	Wounded.	Missing.
17	9	5	52	19	2
Total, 31.			Total, 73.		

The loss of horses is here out of all proportion to the men; the French evidently fired at the horses. The loss of the men was about 10 per cent., whilst that of the horses was 24 per cent. The percentage of hits is remarkably low, considering that the range was very short.

In the same battle a battery of Prussian artillery lost 41 men and 97 horses; a second battery lost 18 men and 36 horses. The guns could not have been removed from the field but for the aid of the infantry. The loss was due entirely to the French artillery fire. In both these cases the loss of horses was double that of men.

Summary of Losses under Fire.

Reviewing these losses from Weissenburg to Sedan we learn that under fire, for every 100 casualties amongst cavalrymen there will be 120 amongst the horses, and for every 100 artillerymen disabled there will be 142 horses.

Taking the losses of horses and men from the battle of Aghrim in 1691 down to Sedan in 1870, and dividing the 179 years into certain periods, we have the following results:—

- 1691—1799. For every 100 cavalrymen disabled there were 148 horses.
- 1800—1865. For every 100 cavalrymen disabled there were 121 horses.
- „ For every 100 artillerymen disabled there were 133 horses.

1866—1870. For every 100 cavalrymen disabled there were 141 horses.

„ For every 100 artillerymen disabled there were 133 horses.

It is curious that in the first period the loss of horses should have been so large, in fact not since equalled, though, in this respect, the third period runs it very close. The third period appears to disprove the theory we had formed of the close connection between the loss of horses and men in recent wars in the cavalry arm; but the undue proportion mentioned above is due to the enormous Austrian cavalry losses in 1866; such a disproportion did not exist on the Prussian side, nor did it exist at Custoza. We are compelled to assume that the influence of the breech-loader and the disasters of a retreat, swelled the Austrian losses to the enormous numbers we have given. Omitting the Austrian losses from our third period we find that in 1866—1870, for every 100 cavalrymen disabled there were 113 horses, and this we may adopt as approximate to the truth of the losses which will occur to a victorious army. If the French losses for 1870 had been obtainable, it is probable that they would have dislocated our table as much as the Austrian losses have done; and that it would have been found necessary to divide the losses into two distinct groups, viz., victors and vanquished.

It is singular to observe that the artillery losses in the second and third periods are identical. As I have not been able to obtain any Austrian artillery losses for the third period, the correctness of the table is not affected.

SECTION II.

OTHER SOURCES OF LOSS.

Hitherto we have only spoken of those losses to horses resulting from the fire of the enemy. It may at once be stated that this furnishes the least loss to which horses are exposed in war, whilst privation, forced marches, exhaustion, and disease furnish the largest. At times these factors may be operating at separate periods, but occasionally they may all be acting at one and the same period, and nowhere is this better seen than during retreats. We purpose, therefore, describing the results of these as influencing the loss of horses.

Napoleon's Retreat from Moscow.

Napoleon crossed the Niemen in June, 1812, with 187,121 horses of cavalry, artillery, and train. It is difficult to arrive at the exact number of cavalry horses, for nearly all authors who have written on the campaign give a different number; it was probably about 60,000.

Very shortly after he crossed the Niemen the weather changed. It had previously been very hot, it now poured with rain; it is said to have rained continuously for five days, and that the fall was quite unprecedented; the result was that the weather became very cold,

the roads were impassable, there was little or no food for men and horses, and it is said that from 5,000 to 10,000 died in a few days, occasioning the loss of 100 guns and 5,000 ammunition wagons! According to Chambray,¹ after crossing the Niemen there were found on the road to Wilna the bodies of 10,000 horses.

It is impossible to believe that this mortality was due to the weather; there were doubtless other causes in operation. We are told that at this time the only food for this vast host of horses was the young growing crops, green rye, barley, and wheat, and there can be no doubt in my mind that much of the trouble produced was caused by this food producing intestinal disturbance. Three years later, about the same time of the year, similar trouble occurred to ourselves, though on a much smaller scale, during the retreat from Quatre Bras on Waterloo; some of the cavalry horses were fed on growing wheat, and they died in a few hours in great agony. This has been left on record by the veterinary officer who had charge of the cases.²

Napoleon always put down the loss of his horses during the retreat to the intense cold, but we have the clearest possible evidence that his cavalry had practically disappeared before the frost set in. His losses at Borodino are not given, but it is said that the greater part of the dragoons perished at this battle; and we are told that so effective was the Russian artillery fire, that of 12 squadrons of a Westphalian brigade only 300 horses were mustered on the evening of the battle. Murat stated that half the cavalry perished in the partisan warfare around Moscow in their search for supplies. On leaving Moscow it was evident that neither gun nor cavalry horses would last very long, they were then practically on the verge of starvation.

The first fall of snow occurred on the 6th of November, and by this time 247,000 men and 92,000 horses had succumbed, and on this date Berthier wrote to Victor, at Napoleon's dictation, and reported that the cavalry was already unhorsed; before this the greater part of the artillery and train had been abandoned. With the snow came intense cold, the thermometer fell 18° below freezing point, and Napoleon in his correspondence says that his horses perished not by hundreds but by thousands. Alison tells us that the Emperor expressed the same views to the Abbé de Pradt, "So also in Russia could I prevent it from freezing? They came and told me every morning that I had lost 10,000 horses during the night. Well, a good journey to them. Our Norman horses are less hardy than the Russian; they cannot resist more than 9° of cold."

Three days after the passage of the Beresina, on 13th December, the *débris* of the Grand Army recrossed the Niemen, 7,000 infantry and 1,600 cavalry. The army had disappeared in six months.

There is ample evidence that the cold had nothing to do with Napoleon's disaster: it aggravated it, no doubt, but it did not kill his horses—starvation effected that. It cannot be too distinctly stated

¹ "Histoire de l'Expédition de Russie."

² Percivall's "Hippopathology."

that if horses are fed and looked after they can withstand extremes of heat and cold, rain and sun, with almost absolute impunity.

During the retreat the horses of the artillery of the Young Guard suffered less than the other artillery horses; but this was due to the fact that during the three days they were left at the Kremlin, after the departure of the army, they found and appropriated a very large quantity of oats which they brought back with them.

I have dwelt on this subject for the reason that the excuse offered by Napoleon for the annihilation of his cavalry, was 42 years later offered by ourselves. In neither case is there a shred of evidence that the cold had any serious influence in the matter.

Retreat on Corunna.

In this retreat—carried out in cold, rain, ice, and snow, over the worst of mountain roads—the chief failing which contributed to the losses was the shoeing. The food supply was not abundant, but apparently sufficient. In the diary of an artillery officer, who was present during the retreat, he only mentions two days on which his battery was without food and rations;¹ though in a diary from the pen of another artillery officer, Captain Wall, who went through the retreat,² he does mention short rations for the horses, but lays especial stress on the absence of shoes and nails; in fact, all authorities concur in blaming the want of shoeing as the chief cause of evil. The army had but few shoes and nails; iron was plentiful in the country, but there was no time for making shoes; mountains, rivers, and ravines had to be crossed; the troops bivouacked in the snow several nights in the mountains; it rained and froze as it fell; baggage animals, artillery, and cavalry horses foundered, and were shot to prevent them falling into the hands of the enemy. The feet of the men failed as well as the horses; wagons were left behind, ammunition blown up, and treasure thrown away. When the horses entered Lugo many of them fell dead in the streets, others were shot, and over 400 carcasses were lying in the streets bursting, putrefying, and poisoning the atmosphere.³

Wall tells us that on 31st December his battery marched 34 miles through deep snow over the mountains, without halting a minute, and that for 145 miles not an hour's halt was made during any day, and merely resting a few hours at night. He says his horses suffered considerably in their shoulders from the collars being badly made.

On arriving at Corunna what remained of the cavalry horses was destroyed to prevent them falling into the hands of the enemy, owing to there being no room on the transports. The destruction of the cavalry created a painful impression, and intensified the horrors of the retreat. The horses were destroyed on the beach, and it is said that many of those awaiting their turn became panic-stricken and broke away.

¹ "From Corunna to Sebastopol."

² "Proc. R. A. Institute," vol. xiv.

³ Southey, "History of the Peninsular War."

This was not the first time we had destroyed horses to prevent them falling into the hands of the enemy. The 11th Dragoons before leaving Holland in 1799 destroyed 152 horses on the beach before embarking, owing to want of transport.

The losses on this retreat have been put at 5,000 animals.

The 7th Hussars landed at Corunna with 680 horses; two months later when they returned only 250 remained.

The 10th Hussars landed with 700 horses and returned with 340.

The 15th Hussars	"	640	"	400.
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The 18th Hussars	"	No record	"	No record
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The 5th K.G.L.	"	470 ¹	"	290.
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During the retreat 17 men of the 10th Hussars died, whilst 60 horses of this regiment died or were destroyed from exhaustion.

A troop of horse artillery lost 15 men and 115 horses.

I cannot ascertain what the other losses were, but it is safe to assume that the cavalry lost about 50 per cent. of their horses, and that four or five horses died to one man. The average daily marching was 15 miles.

In the letters of General Sir A. S. Frazer, R.A., he mentions that the Corunna campaign cost the cavalry 4,000 horses and 1,100 men out of 7,000 of each, which makes the cavalry loss in horses 57 per cent., and in men 15·7 per cent., but this strength in cavalry cannot be correct; there were only five regiments present. Beamish² puts the strength of the cavalry at 2,278.

Retreat from Catalonia.

Brigadier-General Gasca's cavalry retreated from Catalonia to Murcia in July, 1811, owing to the fact that they could not be fed. There were 1,066 men and 500 horses. In six weeks they marched between 700 and 800 miles. The horses when they started were in miserable condition, and they marched through the country held by the enemy without money or food; the marching was often done at night; they were constantly attacked by the enemy, had to ford rivers, &c., and reached their destination with a loss of 157 men and 213 horses. The loss of the men was 14·7 per cent., whilst that of the horses amounted to 42·6 per cent.

Wellington. Retreat from Salamanca.

Wellington retreated from Salamanca to Ciudad Rodrigo with troops and horses verging on starvation. The distance was 240 miles; the weather dreadful, owing to incessant rain; rivers, stony and ploughed lands, and swamps had to be crossed. No food for the horses, excepting the bark of trees and sprigs of wild briar; on one day's march the ground was so heavy that the horses sank over their

¹ The exact number is not quoted; after deducting the deaths at sea and the sick and lame on landing, this is what remained.

² "History of the King's German Legion."

fetlocks. The loss of horses was 280, or more than one for every mile traversed.

Massena's Retreat from Portugal.

Massena retreated from Portugal with 8,800 horses: during the 10 days the retreat lasted he lost 112 horses killed, 1,741 died, and 102 were captured, a total of 1,955 or 22·2 per cent., or a loss of 195 horses per diem. I cannot compare this with the loss of men, as the tables given in his Memoirs do not distinguish between each branch of the service, but he lost in his ten days' retreat about half as many horses as he had lost during his previous five months' campaigning.¹

Starvation.

Our difficulty is not in finding examples of the loss caused to armies in the field from starvation or insufficient food, but rather to find any big campaign where this has not occurred. Napoleon's troubles in Russia, and Wellington's complications in Spain, were all attended and even induced by insufficient food for both men and horses.

There is nothing which tells so early on animals as short and insufficient rations; in this respect they show starvation much earlier than men, and, further, they take longer to recover. There are physiological reasons why this should be so into which we cannot enter, but there are also psychological explanations. Murat complained to Nansouty during the 1812 campaign that the cavalry charges were not executed with vigour. The latter replied, "The horses have no patriotism; the soldiers fight without bread, but the horses insist on oats." There is more in this than lies on the surface.

In the Peninsula hundreds of horses died from starvation. Writing in August, 1809, the Duke said that the daily and increasing loss of horses from deficiency of food, and from the badness of what there was, was really alarming. The horses had not received three regular supplies of barley for 28 days. In 1812, before Ciudad Rodrigo, the cavalry regiments lost heavily from starvation. It was due to the loss of horses from starvation, and the exhausted condition of those living, which, with other causes, determined Wellington retreating from Salamanca.

An army may be starved in an enemy's country even when no actual fighting is occurring. The army of the Indus which entered Afghanistan in 1838 affords a good example of this. On their way to Kandahar, *viâ* the Bolan, the force was starved. No food and but little water was to be had for them, and the animals, especially horses, melted away. Sometimes they would get no food for days. The cavalry loss was from 40 per cent. to 60 per cent. in the 13 months occupied by the expedition, whilst 3 elephants, 30,000 camels,² 264 ponies, and 623 bullocks died. Practically, none of this

¹ "Mémoires de Masséna," Koch.

² We managed to double this number in the last Afghan War.

loss was due to the fire of the enemy, but wholly to exhaustion and starvation.

The most melancholy example of the starvation of an army occurred in the Crimea. It is singular to observe, in reading the evidence taken by the Chelsea Commissioners, how they dwell on exposure as the cause of the disappearance of the cavalry. Experts who were sent to make their enquiries on the spot were of opinion that stables or shelter of some kind would have saved the brigades. In fact, we made the same absurd excuses which Napoleon made in 1812.

We starved our horses to death—of that there can be no doubt. Animals do not start on each other's manes and tails until compelled by dire necessity; nor do they eat the spokes of wheels and the bottoms out of carriages if they can obtain a more satisfactory source of supply. We landed a force and failed to feed them—starved the horses to death, and then blamed the commanders for not keeping them alive! I have no hesitation in saying that the winter had nothing to do with the death of these horses. They would have died just the same had it been summer, the only difference being that they would probably have taken a little longer over it.

Though a nation of horsemen, we have, apparently, got to learn that horses must be fed if they are to be kept alive—as Nansouty said, they cannot live nor fight on patriotism—a pound or two of hay or a handful of grain every third day can only have one termination.

Here are our Crimean losses (cavalry and artillery) for the six months ending 31st March, 1855:—

Cavalry.

	Heavy Brigade.	Light Brigade.
Number alive on the 1st October, 1854	930	1,087
Joined since.....	125	74
	<hr/> 1,055	<hr/> 1,161
Killed in action or destroyed for wounds ...	73	353
Transferred to other corps	10	136
Died or destroyed in consequence of disease	493	439
	<hr/>	<hr/>
Remaining alive 1st April, 1855	479	233

During the six months under observation the loss of the Heavy Brigade from sickness alone (starvation) was 47 per cent., and of the Light Brigade 38 per cent.

Artillery.

Number of horses alive on 1st October.....	2,081
Since joined	751
	<hr/> 2,832
Killed in action or destroyed for wounds	96
Died or destroyed in consequence of disease.....	1,190
	<hr/>
Remaining alive on 1st April, 1855	1,546

During the six months the artillery loss from disease alone (starvation) amounted to 42 per cent.

The Total Loss of Artillery and Cavalry Horses for the Six Months ending 31st March, 1855.

Strength on 1st October, 1854	5,048
Killed in action or destroyed for wounds	522
Died or destroyed for disease (starvation)	2,122
	<hr/>
Remaining 1st April, 1855	2,258

Out of 2,329 transport horses and mules landed in the Crimea during the six months mentioned above, 200 were destroyed or died from sickness, whilst 689 "died from severity of the weather, fatigue, and exposure." I have quoted the official designation of this loss. For "severity of the weather" read "starvation."

The transport loss was 38 per cent.

Reverting again to the cavalry losses, Lord Lucan put them down to the fact that the cavalry was employed on transport duties, and he stated that between 12th December, 1854, and 17th January, 1855, no less than 426 horses of the division had died. The largest loss on any single day was the 6th January, when no less than 43 horses died.

It is certain that the mere fact of employing cavalry horses to bring up ammunition to the front would not kill them had they been fed, and they might just as well have been employed on some useful duty as standing idle at their pickets. But work, in such weather and with such roads, cannot be performed on a couple of pounds of barley and a mouthful of hay!

General Foy said that three-fourths of the horses in France were frozen to death in Russia; we may certainly say that more than half the horses which landed in the Crimea never returned. Even at this distant time a perusal of the tables I have given produces a feeling of mortification.

Defective Shoeing.

Defective shoeing as a cause of inefficiency is probably present in every campaign to a greater or less extent. By the term defective shoeing I mean everything in the form of shoeing which can possibly fail. There may be both shoes and nails in abundance, and yet, owing to the fact that military operations are being carried out with great rapidity, no time is left for the shoeing of the horses, and inefficiency results. In the Austrian campaign of 1866 the German cavalry pressed the enemy so closely that the horses could not be shod, and the lameness and other inefficiency which resulted from this was most serious. General Hartmann's cavalry division had marched 16 miles to the battle of Koeniggratz, it was ten hours engaged with the enemy, and in pursuing the retreating Austrians marched 97 miles without a break in three days; although the sick and lame had been left behind, yet each regiment by this time had

150 horses unfit for service, and one-third the horses of the Landwehr Brigade were lame. All this was due to the severe work and the impossibility of keeping the horses shod.

Sir John Moore's campaign is the best example of the damage which arises to the feet from want of proper precaution and from defective shoeing. The 7th, 10th, and 15th Hussars were landed at Corunna after being at sea about three weeks, and a few days after disembarking they marched up the country by squadrons in daily succession, occasioning the last squadron to be later in its march by nine days than the first. In the 1st squadron 20 cases of fever in the feet occurred, and the horses were left behind, and such continued to be the case more or less all along the line of march. Still the first suffered much more than the last, a circumstance which induced Mr. Castley, veterinary surgeon to the 15th Hussars—who records the case!—to consider that the immediate exertion to which the horses were put after standing so long on ship-board was the cause of the trouble. We now know that had these horses been exercised for a few days the cases would not have occurred.

In the Corunna campaign the shoeing broke down entirely. No shoes or nails were obtainable, the long and heavy marches wore the feet down to the quick, and this, coupled with the severe work, produced many cases of fever in the feet, or founder. The 3rd German Hussars reached Corunna with 290 horses. Only half this number was effective, the rest were lame from defective shoeing or wounded. In no campaign was this condition so marked. Shoeing was always a trouble in the Peninsula. The farriers could not do the amount of work required, and Wellington recommended that shoes should be sent out from home ready made. There is very little new under the sun—this is our present system.

In the Civil War in America the shoeing of the horses in both armies was in a deplorable condition, through being short of farriers and material. McClellan says that it was no uncommon thing to see a soldier leading a limping horse, whilst from his saddle dangled the hoofs of a dead horse which he had cut off for the sake of their shoes.²

There is no branch of shoeing the "neglect" of which so suddenly paralyses the movements of an army as defective frost shoeing or "roughing." History furnishes many examples of this, the most notable of which occurred in Napoleon's campaign in Russia. General Wilson, in his "Narrative of Events during the Invasion of Russia," describes it as follows: "On coming to the first enemy's bivouac on the morning of the 5th November, some Cossacks accompanying the English General (Wilson), seeing a gun and several tumbrils at the bottom of a ravine, with the horses lying on the ground, dismounted, and, taking up the feet of several, hallooed, ran, and kissed the English General's knees and horse, danced and made fantastic gestures like crazy men. When the delirium had somewhat subsided, they pointed to the horses' shoes, and said, 'God has made

¹ "The Campaign of Stuart's Cavalry."

² Percivall's "Hippopathology."

Napoleon forget that there was a winter in our country. In spite of Kutusow, the enemy's bones shall remain in Russia.' It was soon ascertained that all horses of the enemy's army were in the same improperly shod state, excepting those of the Polish Corps and the Emperor's own, which the Duke de Vicenza, with due foresight, had kept always rough-shod as is the usage of the Russians."

Napoleon, during the retreat, was endeavouring to reorganize his army, now reduced to 5,000 cavalry. Arms were distributed; hand-mills to grind grain had recently been received from Paris, these were issued, and thrown away immediately afterwards as useless; but no frost nails were to be found amongst the stores, and that was the article most wanted for the efficiency of the artillery and cavalry.

It is not possible to say how far the possession of frost nails by the French Army at this critical period might not have influenced the tide of European affairs.

During the retreat of the Danes in the Schleswig-Holstein campaign, 1865, a sudden frost set in the day this step was decided on. The roads were like glass and not a horse in the whole army was rough-shod. The "Times" correspondent, who was present, gives a very graphic account of the misery and wretchedness of this night's march, with a heavy snow falling, intensely cold and dark, everybody dismounted leading his horse, whilst others were employed holding up the draught horses, and dragging guns, ammunition wagons, &c., by hand. It took nine hours to do less than seven miles of marching, and the whole road was choked by dead and dying horses, broken axles, guns, and wagons. The pursuers were, fortunately for the Danes, also unroughed.

In 1870-71 the Army of Bourbaki suffered severely during its winter retreat from the absence of any means of roughing, whilst the Germans, profiting by their 1865 experience, were able to move, as a French officer expressed it, "with no more difficulty than on the finest roads."¹ The Germans, in their official account, are rather silent on the subject, but I gather that they had a little more difficulty in the matter than the French officer represents. Hozier, in his "Franco-German War," specially alludes to the uselessness of the German cavalry in the actions preceding the capture of Le Mans, owing to the slippery state of the roads. A strange sight was presented by the army as it struggled over the icy roads; even the Prince had to dismount and walk; most of the staff and cavalry escort were also dismounted; others, mounted, forced their horses to struggle on in the ditch by the side of the road. The horses of the artillery and train were falling every instant, and ice nails became worth nearly their weight in gold.

Sore Backs.

Perhaps as a cause of inefficiency, especially of cavalry horses, sore backs will take precedence of all other causes. Probably every army which has taken the field since saddles were introduced has suffered

¹ "Revue Vétérinaire," October, 1876.

more or less from this evil; to an extent it is inseparable from military operations, yet we are bound to recognise the undoubted fact that sore backs occur in very much larger numbers than they should, and, further, that with great care and an improved type of saddle they are capable of considerable reduction.

It is not my intention to point out the causes leading to the production of sore backs, further than to say that there are several factors at work in the matter, of which the weight carried, loss of condition, and a defective type of saddle are the most prominent.

It is very strange that, in spite of the frequency of sore backs on service, little, if anything, has been written about it; it is only by an incidental remark made here and there by authors and historians that we can be positive the evils which affect us in the present day affected our forefathers; but there is no reason why the literature of campaigns from Waterloo downwards should preserve such an absolute silence on this important question. The Germans, who do everything in a very thorough manner, make no mention in their official accounts of the sore backs their cavalry suffered from in 1866 and 1870, and yet we know the first campaign especially, though it only lasted for a few weeks, was long enough to produce a considerable amount of inefficiency in this direction.

The magnificent appearance of the force which crossed the Niemen in 1812 was to a great extent deceitful. The marches they had made up to the Russian frontier had been prolific of many causes of inefficiency amongst the cavalry, and especially in the production of sore backs. Unger¹ states that more than half of the cavalry had sore backs, whilst Mitchell² speaks of the many sore backs which were actually rotting under the saddle, "for the French trooper has little affection for his steed, pays little attention to the animal, and still less to his saddling and appointments." In my experience the French trooper is by no means singular in his neglect of his horse.

Wilson³ tells us that the horses captured by the Russians from the French in 1812 were perfectly useless, owing to their sore backs and low general condition. We have thus ample evidence that the Grand Army, in spite of its experience of war, was just as liable to the scourge of cavalry as ourselves.

Nothing is to be derived from our "Peninsular" histories of the amount of inefficiency resulting from sore backs; it is only through the medium of professional papers⁴ that we are briefly told of the amount of suffering inflicted and the condition of the backs in this campaign.

Of the Waterloo campaign, short as it was, we have the undoubted evidence of Mercer,⁵ who says "for with all our care we have a number of galled backs and shoulders, though in this respect we are

¹ "Exploits et Vicissitudes de la Cavalerie."

² "The Fall of Napoleon."

³ *Op. cit.*

⁴ Percivall's "Hippopathology."

⁵ "Journal of the Waterloo Campaign."

not half so bad as the cavalry, amongst whole squadrons of whom there is scarcely a sound horse."

In the Eastern campaign of 1854-55 our cavalry had little else to do both before and after Balaclava than to submit quietly to be starved to death. Before they left Turkey for the Crimea a reconnaissance was made by Lord Cardigan towards the Danube, at the angle of the Dobrudscha; the strength of the force was about 300; before they had marched 30 miles several horses were sent in lame and otherwise disabled. The force was away 17 days, and they marched in, according to Calthorpe,¹ with 90 sore backs out of 280 horses. Russell, who very properly speaks of it as the "Sore Back Reconnaissance," says about 100 out of 280 horses were disabled.² Until the publication of the Annual Reports of the Veterinary Department this was the only record in existence, so far as I am aware, which conveyed with exactitude any notion of the amount of inefficiency which is capable of being produced by sore backs.

A note on "Russian Remounts" appeared in the "Bulletin de la Réunion," from the pen of a Russian Cavalry Officer serving in the Balkan Campaign, 1877.³ He mentions that the 8th Russian Hussars marched 348 miles in 16 days, or less than 22 miles a day; of four squadrons two had their feet all to pieces; the other two were terribly pulled down, and in the 4th there were 26 sore backs. The 8th Cossacks were in the same brigade. They had nearly 35 per cent. of their horses on the sick list, and if they had marched seven days more it was calculated that half the regiment would have been on foot. After the cavalry reached Bulgaria each regiment could only parade a single squadron with difficulty, and those horses not sick were in a "dreadful state."

The conditions which have existed in the past exist with us to-day, and will exist so long as we make one horse carry in weight the equivalent of two men.

Heel-rope Galls.

Heel-rope galls—incorrectly so termed—are at times a very serious source of inefficiency. I mention them here, as they are absolutely preventable, and with care such a thing should be unknown. It is generally supposed that a heel gall or head-rope gall—properly so called—is produced by the heel rope, but such a thing is unknown; heel galls are produced by the *head rope*, and they can only occur under one condition, viz., leaving the head rope so long that the horse gets his leg over it; in this position one hind leg gets caught up, and the horse—whose intelligence is only to be met with in books—saws his leg up and down the rope until he has produced sufficient damage in three minutes to take eight weeks to repair. With head ropes 3 ft. 6 ins. to 4 ft. long, heel galls are an impossibility. Such injuries should never figure in our returns; they are the best example of preventable injuries.

¹ "Letters from Headquarters."

² "Army and Navy Gazette," March 11, 1893.

³ "Proc. R. A. Institute," vol. xii, Captain Roche, R.A.

Exhaustion.

This is a very comprehensive term, signifying an inability on the part of the horse to work as a result of one or more causes.

We have spoken of starvation, and we all know that if horses are not fed they cannot be worked; but we have now to learn that even if fed they cannot be worked beyond their strength; in other words, an unlimited supply of food will not produce an unlimited amount of work; the human and animal organism is only capable of producing with useful effect a certain amount of daily work, but this quantity has, of necessity, to be neglected where important military operations are concerned, and where great events may depend upon the men reaching a certain point, even should their horses afterwards die as the result. I take it, however, that this condition is not of every-day occurrence in warfare, and, on the principle that dismounted cavalry are no longer formidable, it is evident that every care should be taken to save the horse as far as possible and husband his strength; this is exactly what the British cavalryman, when away from the eye of his officer, makes no attempt to do. Field-Marshal Sir J. Burgoyne¹ says that in the Peninsula it was most noticeable the difference in the care bestowed on the horses by the British and German dragoons; the horses of each force lived on the same forage and were of the same breed, so that the only possible difference to account for the marked difference in condition and fitness for work was the care bestowed by the men, and he tells us so marked was this distinction between our cavalry and that of the Legion, that the latter could put 100 horses in the ranks to our 10!

Mercer, in his "Diary of the Waterloo Campaign," draws a contrast between the German and British dragoon, and he says that affection for and care of his horse is the great distinction between the two. "The former," he says, "would sell everything to feed his horse; the latter would sell his horse itself for spirits or the means of obtaining them. The one never thinks of himself until his horse is provided for, the other looks upon the animal as a curse and a source of perpetual drudgery to himself. . . . In the Peninsula the only means of enforcing some attention to their horses among our English regiments was to make every man walk and carry his saddle-bags whose horse died or was ill."

These side lights on the Peninsular mortality are very instructive. I wish I could feel that there was no cause for apprehension in the future in the direction we have mentioned. I yield to no one in my appreciation of the British dragoon as an individual, and with a limited experience of foreign cavalry I do not consider from what I have seen that the two can be placed in the same class; but a more careless or thoughtless man with horses it is difficult to imagine.

History teems with examples of rapid movements of armies and units, some of the marching and distances covered being extraordinary, but it is essential to remember that the movements are very costly in horseflesh, and further, that there is probably no animal

¹ "Military Opinions."

which succumbs sooner to exhaustion than the horse. There are several reasons for this: his body reserve is comparatively small owing to his daily requirements being so large; further, in rapid and forced movements little or no time is allowed for feeding. It does not appear to strike the ordinary mind that horses require a certain number of hours' idleness for feeding purposes alone. It takes a good feeder 10 to 15 minutes to eat 2 lbs. of oats, and it takes 1 hour to eat 4 lbs. of hay. It is safe to say that a horse spends $4\frac{1}{2}$ hours out of every 24 doing nothing but feeding, and this is the least amount which should under ordinary circumstances be allowed him. But military necessities know no law, and if the horses had the food to eat, in many cases no time could be allowed them to consume it. Take the case of General Hartmann's division in the war of 1866, quoted on p. 300. It is pretty safe to say that when prolonged exertion of this kind is demanded, 25 per cent. of the horses will be laid up in three or four days.

If troops in a state of exhaustion have to come into action, their effective is materially reduced. At Borodino the French cavalry, towards the end of the day, charged at a slow trot. No other pace could be got out of them owing to their state of previous exhaustion.

Wellington bitterly complained of the manner in which the horses, both cavalry and artillery, fell to pieces in the Peninsula; he urged that no horse should be sent on service under six years of age; further, he stipulated that very old ones should not be sent, remarking that he had known a remount of old horses killed by one day's work. The harassing work performed by the cavalry not only produced great mortality, but the horses fell into a state of extreme exhaustion. In one of his despatches he says, "It is inconceivable how fast both the horses of the cavalry and artillery fell away. When horses as well as men are new to war, I believe the former are generally the sacrifice of their mutual inexperience."

It is not our intention to give examples of the exploits of cavalry in distance marches under trying conditions; but we cannot refrain from noticing two marches which, though not of very great length, are still associated with military operations of great importance.

In 1866 Bredow's 5th Cuirassiers marched 200 miles in seven consecutive days, bivouacking daily often in heavy rain; they came up with the enemy at Tobitschau with the results mentioned on p. 286.

The 1st Prussian Dragoons of the Guard left their bivouac at Beaumont at 4.30 A.M. and marched to Mars-la-Tour, which they reached at 1.30 P.M., a distance of 35 miles. At 5.30 the same afternoon they executed that memorable change which nearly cost the regiment its existence.

There can be no doubt that, considering the active share in the operations which the cavalry had taken up to Mars-la-Tour, that they must have been in a very effective condition to have executed this brilliant charge after a long march.

The loss in draught horses from exhaustion is generally very severe; rapid movements of artillery or prolonged draught on heavy roads are most destructive.

At the commencement of the siege of Plevna there were 66,000 draught horses used for supplies, ammunition, &c., from Sistova to Plevna. At the end of the siege there were 44,000 left, no less than 22,000 had succumbed. These animals were killed by over exertion and mud, and do not include those killed in action.¹

Loss in Transport by Sea.

We have dealt with the chief sources of loss of horses on service, but cannot refrain from mentioning one cause not associated with active service in the field, but with their transport by sea to the base of operations.

The loss on board a ship is often a very serious matter. The horse, physiologically speaking, was never intended as a sailor; he cannot vomit, and in consequence suffers from certain disorders of the brain from which he would otherwise escape; further, he has of necessity to be confined within a very narrow space in the horse stalls, and where these are situated low down in the vessel, or, as is not uncommon, close to the engines, he suffers from the heat, and the vicious atmosphere produced by defective ventilation. Under favourable circumstances the losses arising from these sources are not extremely heavy. The chief and serious loss is due to the horse fittings giving way during bad weather, and the living and panic-stricken freight being tossed from side to side and their lives battered out of them. In this way many of the horses are killed or so damaged as to necessitate destruction.

During the Peninsular War the loss of horses on board a ship was by no means heavy. The Duke in his despatches particularly mentions this, and looked upon the risk as trifling, though the voyage to Portugal occupied about the same length of time as a voyage to India in the present day. I can only attribute this comparative immunity to better and more substantial horse fittings. The following losses appear to have been exceptional, and due to a very prolonged stay on board a ship. The 3rd Hussars of the King's German Legion landed their horses in Portugal after being 17 weeks on board a ship. Forty horses died or were destroyed for glanders, and when the regiment was mustered on shore, scarcely half of its original number was fit to take the field; 145 men and 125 horses were left behind—the men from dysentery, the horses from fever in the feet, caused by standing so long on ship board.²

In the Crimean campaign the losses were extremely heavy. Russell speaks of the inefficient condition of the artillery at Scutari, owing to the loss of horses on the passage. The 1st division of artillery lost on the voyage 27 horses out of 340, or nearly 8 per cent., which is exceedingly high. Colonel York, commanding the Royal Dragoons, stated, in a letter to the "Times," that the Royals lost 175 horses at sea between Varna and Balaclava. A corporal of dragoons

¹ Irving Montagu, "Wanderings of a War Artist," "Illustrated Naval and Military Magazine."

² "History of the King's German Legion."

(no regiment mentioned) stated in a letter that the "Wilson Kennedy" in the journey from Varna across the Black Sea was caught in a gale of wind, the horse fittings gave way, all the horses were thrown over to one side of the ship, and in one night more than 100 of them kicked and worried each other to death, and for two days and nights the troops were battered down with the dead and dying horses. Only eleven were saved on this ship, and on the third day 101 were thrown overboard.¹

In the evidence taken by the Chelsea Commissioners, Lord Lucan, in dealing with the losses of horses at sea, said that the Heavy Brigade lost 226 troop horses on the passage from Varna to Balaklava, and that some of the officers lost all their private horses. The brigade landed in such a condition from bad forage at Varna and a bad sea passage, that Lord Lucan says he could scarcely have recognised them.

Losses due to the physiological construction of the horse cannot be averted, but losses due to suffocation, poisonous atmosphere, and fittings giving way are clearly within the bounds of prevention.

In June, 1802, a troop of the 8th Hussars took 150 Arab horses from Egypt to India; only 51 were landed at Madras, the others died on the passage; the mortality it is said being due to the weather.

In the expedition to South Carolina, a detachment of the 17th Lancers lost nearly all their horses at sea, due to bad weather.

Bad weather we cannot help nor prevent, but the horse fittings of a ship have no more right to give way than the bottom of the ship has to fall out.

Stampedes.

A great deal has been written about the intelligence of horses, but I cannot help but think that his faculty of intelligence has been greatly overrated. That he has a good memory is undeniable, but that he is blessed with any large amount of intelligence is not my experience.

It may be said that the fact of his being liable to panic is no proof of his want of intelligence, as panics are not unknown to the higher animal man; this, in a measure, is true, but the causes which give rise to stampedes are often so trivial, that if the horse had more intelligence they could not alarm him.

Stampedes are common associations of military service; we suffered from them in the Peninsula, the French in Turkey, the Russians in the Crimea, and, later, in the Russo-Turkish War; whenever, in fact, large bodies of horses are brought together in the open this infectious nervous explosion is liable to occur.

The night before the battle of Salamanca a severe thunderstorm occurred, with very heavy rain; the cavalry horses were linked together. The 5th Dragoon Guards lost many of their horses, the 3rd Light Dragoons had one officer and 16 men severely injured by their linked horses running over them; the 4th Light Dragoons, on the other hand, lost no horses, owing to the fact that they were better linked.

¹ "British Battles by Sea and Land."

All that night, and the following morning until the battle began, from the General commanding the cavalry downwards, all were employed in endeavouring to secure the runaways. 31 horses were not recovered. Thunderstorms and heavy rains are a common cause of this disaster.

At Aranjuez the horses of the 13th Light Dragoons stampeded; they were unbridled and feeding, but linked together, and the men lying down. The 2nd German Hussars having been ordered to join Lord Wellington were filing past, the 13th sprang up and greeted their old comrades with a parting cheer, which so alarmed the horses that four troops stampeded; the horses strayed 4 or 5 leagues, but were all recovered.

I once knew a stampede to occur when a regiment was quietly watering at a large pond; it was probably produced by one horse pawing the water and splashing his companions; the effect was electrical, the whole troop went about, dashed into those behind them, and one-third of the regiment got away.

Loss from Disease.

It is not my intention, owing to lack of material, to attempt to deal with the loss of horses in the field from disease; the losses are naturally very heavy, and in days gone by must have been alarming, but no complete statistics of any campaigns are available, excepting those which have occurred within the last few years, viz., since the Afghan and South African War of 1879, and in these wars it has not been so much the loss of horses as the loss of transport animals which has been so heavy. I have not attempted to deal with the latter, it would require a paper in itself to do it justice.

From the Wellington Despatches I have obtained two field states, one is dated 1st November, 1809, and shows the strength of the cavalry at 2,765, of which 12·6 per cent. are sick, and of the sick no less than 12 per cent. died. The artillery strength on the same date was 1,062, of which no less than 30 horses had died in one week.

On 9th January, 1813, the strength of the cavalry was 5,476 horses, of which 13 per cent. were sick. The returns for 1809 and 1813 are so close that we may accept the percentage as probably representing the average sick in the Peninsula.

In the Crimea, on the 26th March, 1855, the sickness was 45 per cent., by the 3rd June it had fallen to 15·8 per cent.

We are probably not far from the truth in saying that we must reckon on having 12 per cent. of the horses always sick, which is about three times as many as during time of peace.

TOTAL LOSSES FROM ALL CAUSES.

The final question we have to consider is, what are our losses likely to be on a campaign?

It is obvious that in answering this question we are beset by many difficulties, we will therefore glance at some of the complete losses which have been experienced.

The Army of the Indus in 1838 numbered 2,310 cavalry horses and men; in 13 months they lost 1,146 horses and 185 men, or nearly seven times as many men as horses; of this loss, the 16th Lancers lost 86 men and 231 horses, including 10 men and 13 horses drowned crossing the Jhelum.

The Bombay column of the Army of Invasion lost 418 horses out of 1,700, nearly 25 per cent., whilst the loss of the Bengal column was nearly 50 per cent.; these numbers include everything—deaths and castings.

In the Peninsula the following are the returns of deaths from all causes, so far as I have been able to ascertain them:—

4th Dragoon Guards.....	239 men.	445 horses.	
11th Dragoons.....	400	500	In 1 year.
13th "	274	1,009	" 4½ years.
14th "	654	1,564	" 5½ "
16th "	309	1,416	" 5 "
	1,876	4,934	"

Or a proportion of 263 horses to 100 men.

As the above regiments were not in the retreat on Corunna, no error arises by including these losses.

The Prussian cavalry losses during the campaign in Bohemia in 1866 were as follows:—

Men.	Horses.	
1,330	Killed or destroyed for wounds ..	873
Deaths from sickness	Missing	240
not included.	Died, exhaustion and disease	1,377
	Cast after the campaign	1,736
		4,226

If we take the strength of the Prussian cavalry at 25,000, their loss of horses from all causes for the campaign was nearly 17 per cent. We do not know how many men died from disease, probably very few, owing to the short duration of the war and the time of the year, making a small allowance for ordinary deaths, would give us a proportion of losses of 300 horses to 100 men, which is probably not far from the truth.

In the campaign of 1870 I can only obtain incomplete records for one regiment—the 4th Hussars. In the whole campaign they lost from all causes:—

Men.	Horses.	
31	Killed in action.....	24
Deaths from sickness	Wounded	42
not included.	Missing	5
	Died or destroyed for disease ...	67
		138

The loss in horses is equal to nearly one-fourth of their strength.

The official returns for the Franco-German War only show the loss of horses in action—killed, wounded, and missing—amounting to the astounding total of 14,595. No returns are given of those which died from disease, &c., but as the army received a supply of 38,000 horses during the campaign, we may assume that the loss from disease was not less than 26,000. In this estimate I have assumed that one-half the wounded recovered in time to continue the campaign; only the wounded likely to recover are shown as such, the others being destroyed are included under the head of the killed.

If we take the mean strength of the German Army in horses to have been 222,000, the total loss for the campaign, on the assumption that the figures I have given for disease approach the truth, amounts to 17 per cent., which, strange to say, is exactly the percentage of their cavalry loss in the Austrian War of 1866.

I have no means of knowing what estimate exists at the War Office of our probable losses amongst horses in future campaigns, and what our requirements are likely to be in remounts, but a consideration of the data I have given shows that we must be prepared with a reserve of from 17 to 20 per cent. to meet all casualties.

The object I have had in view in bringing this subject forward is to direct attention to those losses which are more or less under our control. The very extent of the question has prevented me from dealing with the hundred and one points in the management, care, feeding, and watering of horses, which contribute not only to their condition but to warding off disease; it would appear almost puerile to tell a man that if his horse is living in the open, and is being fed from a nose-bag with a hole in it, that a loss of condition results, or that if he only waters the animal the regulation three times a day when it needs it four times a day, that his horses will not be as fit as they should; but it is just this very attention to details which distinguishes the horse master from the tyro, and which represents the difference between fitness and health, or loss of condition and disease.

Of all animals the horse is the one which soonest shows the result of neglect and ignorance, or of care and management. On none of these points have I had space to touch.

It may be considered that, in suggesting there is so much room for improvement in the care and management of horses in the field, I have not taken the trouble to inquire how we have handled these matters in recent campaigns, since our information has been so much more exact, and our training so much better. I have studied recent campaigns and I see no improvement; as supporting this opinion, I will take the last campaign in which any numerous body of cavalry were engaged. I allude to the campaign of 1882.

We landed in Egypt 1,767 cavalry horses, and of these, in about three months no less than 352 had died, been destroyed, or killed in action, a loss of nearly one-fifth of the force; of the four-fifths remaining, the returns do not show how many were effective, but it is a well-known fact that one regiment had 213 horses on the sick list at one time with sore backs, heel-rope galls, and debility!

The total strength of horses for all branches of the Service landed in Egypt was 5,000, of these 2,567—or more than half—came under veterinary treatment, and 592 died or were destroyed, nearly one-eighth of the force; of those which died, the principal source of loss was exhaustion, 154; debility, 30; apoplexy, 11; fever, 114; gunshot wounds, 22; killed in action, 53.

The total number of sore backs was 517, of which 2 died and 21 were destroyed! The total number of sore backs, harness galls, and heel-rope galls was 896!

One regiment landed in Egypt with 466 horses; in three months, from various causes, it had lost 114!

Finally, at Suakim in 1885; a regiment of cavalry, 200 strong, furnished in one month 68 sore backs, whilst a second regiment of the same strength furnished 23.

With these facts before us, there is sufficient evidence to show that there is considerable room for improvement in the reduction of the preventable loss of horses in war.

FOREIGN SECTION.

THE WARS OF FREDERIC THE GREAT.

By the German General Staff. (Précis of the Introductory Chapters.)

By Captain MAUDE, late R.E.

THE starting point for all modern tactical study in Germany during the last fifteen years has been the first Silesian War. Unfortunately for the cause of progress in England no reliable data as to the methods of war then in use have hitherto been available in our own language, and as the work from which the following notes are taken is far too bulky for private enterprise to translate and publish, the following précis of the most important introductory chapters is herewith offered to the readers of the Journal.

The evolution of the art of war, on the conclusion of the wars of the Spanish succession, had entered on a period of stagnation and partial retrogression. The principles of fighting which had evolved themselves during the Wars of Louis XIVth had remained in the main unchanged, but their practical application had lost in energy, and the initiative of the leaders had been sacrificed.

The actual combatant army practically consisted of cavalry and infantry only in the proportion of one to three in Prussia, one to four in Austria and her allies, and not quite one to six in France. The artillery was very weak indeed, only one light piece (3-pr. generally) for 1,000 men and a few heavy guns, say 10 to 15, 12 to 24-prs. as a reserve.

With a view to maintain unity of direction over the whole, and to develop the fire power to the utmost, the "Line" had been evolved.

The tactical unit of the infantry was the battalion in line four deep, but in Prussia for fighting purposes only three deep, which was divided into sections and divisions, which stood side by side without intervals, so that the battalion formed a unit complete in itself. The number of the sections and divisions differed, but was usually four of the latter, each of two sections, so that the sections corresponded with our companies, but the division was made on parade with no reference to the actual strength of the "company," which was purely an administrative unit, as it still is in our own service. The line was the sole fighting formation; columns were only used for purposes of movement, and of these there were three forms, viz., column of divisions, column of sections both at wheeling distance, and for short lateral movements a column formed by turning

the line, to the right or left, which gave fours or threes. It is curious to notice that just as till quite recently the Prussians recognised two forms of line, viz., three deep for manœuvre and two deep for fire, so they then had a four deep line for drill purposes, but only used a three deep one for firing. Column of sections was formed from the right only, exactly in the same manner as we still do on the command. "Advance in column from the right." To move to a flank the companies are wheeled as in "Break into column to the right or left," and this was the ordinary formation, for though the roads were far worse than nowadays, they were mostly much broader, and on approaching a defile the front was reduced by breaking off files, generally from the left, and during the march the distance between the ranks was increased to four paces. To form line from this column to the front, the head changed direction right or left, and continued to advance the full length of the column and then wheeled into line. To form line to a flank they merely wheeled into line in the usual way.

Fire was only delivered by word of command and either by ranks, or by sections or divisions. The former was the usual method in all other armies, but the Prussians used only the two latter; but in all, the first rank knelt and the other two locked up. The division or section fire began on the flanks and worked inwards, and was so regulated that one half of the battalion always stood with loaded arms at the shoulder, whilst the remainder were loading or firing, and the utmost possible care was given to secure machine-like precision and rapidity in its delivery by ceaseless practice in the firing exercise, thanks to which, after the introduction of the iron ramrod, the Prussian rate of fire reached five rounds a minute—about three times faster than in any other nation. Generally speaking, the attack took place in line, and in order to bring up the battalion as a closed body, it could only advance with small and slow steps, the pace of 28 inches and the cadence 75 to 80; but marching in step was as yet unknown, though they did march in time to the beat of the drum, increasing or diminishing the rate as indicated by the instrument.

The great difficulty of the time was to combine fire and movement, for only under these circumstances did the attack become possible. but in most armies the want of adequate peace-training placed almost insuperable difficulties in the way. As a rule the attack came to a stand after passing through the zone of the artillery fire and entering that of the musketry, the losses then soon brought the assailants to a halt; then ensued, either with or without word of command, a stationary fire-fight. After this had lasted a time the officers either did or did not succeed in stopping it and forcing the line forward with the bayonet.

Of course there was no want of suggestions as to how to secure the desired end. Some Generals believed it possible to push straight in with the bayonet without firing at all, and amongst these was no less a person than Maurice de Saxe, who says in his *Reveries*, "The fire-arm is not so terrible as one thinks, few men are killed in action by fire from the front. I have seen volleys that did not hit four men,

and neither I or anyone else saw an effect sufficient to have prevented us from continuing our advance and revenging ourselves with the bayonet and pursuing fire." All, however, agreed in the importance of postponing the halt to fire as long as possible, and then keeping it strictly under control.

The Austrians covered their advance by their grenadier companies who were employed entirely as our old skirmishers, halting, firing, loading, and running forward, whilst the closed battalion followed in rear without checking. If the attack failed, then, whilst retreating, named files had to halt, front, fire, and regain their places in the ranks. This was the general method of fighting in use in all countries, and if the Prussians succeeded therein in excelling all their competitors, this was due to their better peace-time training and to their truer comprehension of the spirit of the game, which led them to attach greater importance to increasing the development of fire, its utilization in the attack, and the maintenance of unquestioning discipline in all movements. Their three deep formation gave them a marked advantage in development of front, and the march in step, which they had been the first to introduce, gave them an additional means of securing order and accuracy in their movements.

The fire in attacking was thus regulated. The battalion advanced in line with bands playing and drums beating. On the command to fire being given, the music ceased, and the portions designated to commence firing halted and made ready, then advanced three long steps, whilst the rest of the line continued to move at the ordinary pace. At the third pace the front rank dropped on the knee, and the two rear rank ones locked up, the volley was delivered, and the body regained its place in the line, loading on the march.

Thus the whole line during the firing of the different portions remained in constant though slow motion, and ceaseless practice as well as the iron discipline in which the troops were trained guaranteed that even in the sharpest fire the movement would be carried out with the regularity of machinery.

The cavalry of the line was organized in cuirassiers, carbineers, and dragoons. As the value of infantry had been so much increased by the introduction of firearms, it was hoped to secure the same improvement in the mounted forces by arming them with the carbine and devoting equal attention to their training in its use. But the idea was overdone, and the true spirit of the arm suffered in consequence. This was more the case in Prussia than in Austria, in which country the true cavalry spirit with which Prince Eugene had inspired his regiments protected them from a similar misapprehension of their duties.

The squadron was everywhere the tactical unit, formed in three ranks, and subdivided into "troops," in Prussia into four as at present. Line was formed by wheeling from column as described above for the infantry. On the march along the roads open column of troops was the normal formation, but across country they often moved on a squadron front. The execution of the charge varied in different armies. In Prussia the regulations of 1727 laid down: "All

squadrons shall advance to the attack with swords at the engage, standards flying and trumpets sounding, and every commander is held bound, on his honour and reputation, to allow no shooting, but always to ride home with the sword." "When squadrons attack they are to move at the trot, and never to wait to be attacked, but always charge first," but at the period of the first Silesian war, these regulations were by no means always attended to. In advancing cavalry against cavalry they generally went straight at each other without manœuvring, sending some skirmishers out from the flanks of the squadrons to prepare the attack by their fire. There was little scope for manœuvring, for the half column was still unknown, and the line to the front, by squadrons moving up by the shortest way, as practised nowadays, was also of subsequent invention, and further the troops were not sufficiently drilled in close bodies, and in jumping obstacles, &c.

In Austria there were two kinds of attack practised, one employed against the Turks, the other against Christians, in the latter case the squadrons advanced with swords hanging from the wrist, and pistols in hand in two ranks. On approaching the adversary the gallop was sounded, the pistols fired in his face at 20 paces, and then the attack ridden home at the fullest speed of the horses, the men being further instructed to hit the horses of the enemy on the head, as "this always has good effect." Against the Turks, however, they moved in three ranks, slowly and well closed up in order to halt in good order and deliver volleys, so great was the terror which these consummate horsemen and their sharp swords had inspired in the Christian ranks.

If the enemy was defeated, a portion pursued whilst the rest rallied, but rallying was so little practised that after a charge the troops generally got out of hand. "Against infantry their tactics were the same, and as a rule the result of such charges delivered at a trot or moderate canter was often a failure," as might be expected, whereas the Turks charging home recklessly at full gallop usually sabred everything they came across, and were so much feared that the infantry took *chevaux de frise*, connected together with chains, into the field with them, and whenever they halted, put up this obstacle in front to protect them.

All line cavalry were trained for dismounted work, particularly the dragoons, who fought like an infantry battalion. Dismounted cavalry were also much employed in the defence of localities. The French adhered to this line of action the longest, whilst in Austria and Germany the tendency to dismounted fighting gradually disappeared. The hussars held a middle place between the line cavalry and the irregulars, and fought mostly as skirmishers. Their leading sections engaged the enemy in front with fire, whilst the remainder followed close behind the flanks, to be subsequently extended against the enemy's flanks. If charged they gave way and sought shelter behind the line cavalry. The irregulars fought partly on foot and partly mounted, much after the manner of hussars, but without closed reserves, and generally with less approach to order. On foot each man fought as a skirmisher for his own hand. In a battle they were

chiefly employed on the flanks and in difficult ground which protected them from the volleys and closed attacks of the regular infantry. The Austrians had in this respect a great advantage over the Prussians and made the most of it, but the want of discipline and love of plunder which characterised these hordes often proved a serious trouble to their own side, particularly when fighting in their own country.

Up to the beginning of the first Silesian war, the artillery had no tactical training to speak of. The men were trained to serve their guns, to prepare ammunition, and in the construction of batteries, and in Prussia they had an annual course of 14 days' target practice. But no artillery regulations existed, and special orders were necessary on each occasion to put together groups or batteries. The light artillery, 3-, 4-, and 6-prs., with an effective range of 1,500 yds., were allotted by pairs to the battalions, and the heavy 8-, 12-, and 24-prs. with howitzers were united in large batteries and employed in the line of battle at suitable places. In the attack after a short period of preparatory fire, the heavy guns were brought up to case-shot range, about 500 yards, and the battalion guns sought to get in to 200 or 300 yards before opening fire, and were dragged up by hand, in advance of the battalion intervals till the infantry firing began. In defence, the guns were placed somewhat in advance of the infantry line and on its flanks, and, where possible, the heavy guns were grouped together in positions from which they could bring a fire to bear on the advancing enemy's flank, and when time permitted they were protected by earthworks and obstacles.

The position of the three arms relatively to one another was laid down in the "Order of Battle," a document which had to be specially prepared for each campaign or minor undertaking. The desire to develop to the utmost possible pitch the fire power of the infantry had led to the diminution of depth with extreme extension of front, the first line being made as strong as possible at the expense of the second, and the third line was very rarely seen at all. The cavalry were placed on the flanks, both to protect these, and also to secure a free field of action. The artillery found no place in the formal order of battle, but, as above mentioned, orders had to be issued for its employment on each special occasion.

The army was further divided into wings, each under a special commander, but these commanders had no separate power of their own. The leading idea was to bring the army into action as a whole, and this intention was further indicated by drawing up the battalions of the first line at equal intervals of 20 paces throughout the line, no special intervals marking the limit of the wing or brigade commands. The sole duty of the leaders of these subdivisions being limited to maintaining the direction ordered, the closing of gaps and the timely support of any portion of the line that might happen to be driven in. (It does not, however, appear how this last duty was to be performed, for the brigade and regimental commands stood side by side, and not one behind the other, so only the wing commander would appear to have had the power of ordering up a battalion or any portion of the second line to the support of the first line.) The second line followed

the first at 300 paces distance as a rule. This distance being fixed so that it should not suffer from the fire aimed at the first one.

The sections devoted to the arrangement of encampments and the different orders of march are hardly of sufficient general interest for reproduction here. It will be enough to call attention to the extreme formality of all proceedings which followed as a necessity from the prevailing conditions of enlistment and culture of the people generally, and the sparse population of the districts in which the fighting mostly took place. As soldiering was unpopular, desertion was rife, and hence it would have been impossible to quarter the soldier in towns and villages, even had such cover existed in sufficient quantity. As the trained soldier represented a considerable sum of money, he was too valuable to be exposed to the chance of sickness which bivouacs would have entailed, and hence the necessity of tents; and the general ignorance of troopers and the absence of reliable maps, more perhaps the want of newspapers, rendered it a matter of extreme difficulty to get full and reliable information of the enemy's movements, hence the necessity of camping in order of battle ready to turn out and fight at short notice.

When a battle was imminent, the General of the attacking side rode out with the advance guard, in order to see with his own eyes where and how his enemy was drawn up, and thereby to regulate the approach and formation of his own forces. As in those days he could approach to a distance at which all details were clearly visible, it will be evident what a wide difference there is between his position then and now, when, owing to the increased range of all arms, and still more to the enormous increase in the numbers engaged, he is compelled to base his plans on the reports conveyed to him by others, frequently emanating from private soldiers who in the first engagements, at any rate of the next war, can only know what the manoeuvres have taught them, and hence the extreme importance of making these as like the real thing as possible is apparent. Thus at Blenheim, Eugene and Marlborough preceded their army with 40 squadrons taken from both wings. The consultation as to the manner of attack and the issue of the necessary orders occupied about an hour, during which the army approached and halted at a distance from the enemy of about a mile.

The formation of the lines then followed. The heads of the columns wheeled to either flank, marched forward their own length, and then wheeled into line. Owing to the low degree of skill in manoeuvring these generally possessed, this operation took considerable time, and, when completed, the advance guard fell back into its place, as assigned to it in the normal order of battle, unless meanwhile some special mission was entrusted to it.

The artillery was now brought up to the front, and endeavoured to silence the enemy's guns, whilst the line remained halted out of their range. After this fire had lasted an hour or so, the army moved slowly forward to the attack, halting now and again to correct their order and direction. The cavalry kept its place throughout this movement on the flanks, till within 500 to 600 yds. of the enemy,

when they rode forward and engaged him. This slow advance, and the constant halts within effective range of the enemy's artillery, was an exceedingly trying ordeal for the cavalry, and demanded a very high order of discipline; as a consequence its leaders were always inclined to curtail the period as much as possible, and attack at the earliest opportunity. Whether such attacks—of which there are many examples—were actually due to impatience of loss, or to a truer conception of the duties of cavalry, in either case the book tacticians of those days seriously blamed them.

If their charge was successful, then, theoretically, only a few squadrons were to pursue the beaten horsemen, but the bulk were to wheel in and fall on the flanks and rear of the infantry. Practically it generally happened that after an obstinate hand to hand fight, the victors stuck to the defeated cavalry, and together drifted away from the battlefield, not returning to it for the rest of the day.

During this cavalry fight, the advancing line of infantry had entered the zone of musketry fire, and now came the real tussle. Even in those days, however much leaders desired it, practically it was not possible to close with the bayonet without firing, the attacking line therefore halted, and a fire fight ensued—if the first line alone could not establish a fire superiority, it was the duty of the second to come up and carry it on. But it will be obvious what an advantage a highly trained infantry such as the Prussian, whose rate of volley firing was three times that of its opponents, must have had in such a struggle, and the superiority once obtained, the advance with the bayonet followed as a matter of course. There was, therefore, no essential difference of principle between the infantry fight of those days and the present, only the struggle for fire superiority takes place within 700 yds. now, instead of within 200 then, and the magazine fire at 300 has practically taken the place of cold steel. The difference in the detail of execution other than that due to distance is, that since nowadays the rate of fire is everywhere equal, as far as the infantry alone are concerned, the superiority can only be obtained by higher discipline ensuring more accurate fire, and its concentration on portions of the enemy's line only. It will be obvious, too, how great the retrogression was when the column was reintroduced for attack purposes, whereby the defender was able to concentrate his fire on fractions of the assailant's force only, and not *vice versa*; but where both defenders and attackers start equal as regards discipline, it will be evident that only the previous employment of the artillery by the latter can give them the requisite guarantee of success, though the power the initiative gives to the assailant of concentrating masses against a line equally strong and equally weak everywhere still leaves a balance in favour of the attacking side.

If the enemy's first line was overthrown, then the order of the attacking line was re-established, and operations commenced against his second one, and this process was repeated till at last the enemy took flight in disorder, when any fresh troops at hand were sent in pursuit; but as a rule pursuits were not instituted, the victors reformed on the conquered ground and advanced a short distance. The

rallying took so much time, and the advance in these ponderous lines was so slow, that generally all touch of the beaten army was lost, and it was left free to continue its retreat unmolested. Cavalry was rarely used in pursuits, and in fact they (i.e., pursuits) were generally looked on with disfavour.

The conduct of the defenders generally depended on the result of the above-mentioned introductory cavalry fight. If the assailants were overthrown, then it frequently happened that his infantry renounced the offensive, and this very partial result was in those days accounted as a victory. If, on the other hand, the defenders' cavalry were beaten, the battle was yet not lost to them, more particularly if the flanks rested on a substantial obstacle. The first line received the enemy with its fire, and the second protected the rear of the former against the returning cavalry, and if the first line was penetrated, the battalions nearest at hand in the second advanced against the assailants who had got through, with the bayonet. If their efforts failed, then the battle was lost, for adequate reserves were rarely provided, and it was impracticable to move one part of either line without compromising the whole. If they succeeded in repelling the attack by fire, then it was the custom to rest contented with the result obtained—counter-attacks were rarely attempted, pursuits still more seldom—for one was afraid of relinquishing the substantial advantages of a selected position, or of risking the carefully-arranged order of battle for doubtful results.

Defence, therefore, was confined to the maintenance of a line once selected; the conception of a sectional defence, or of the offensive-defensive, had scarcely developed itself.

In case retreat became unavoidable, the first line retired through the intervals of the second, which had to resist until the first had again selected and occupied a position in order to take up and cover the second, when it in turn fell back, the same course being also followed by the cavalry. If the retreat took place in disorder, then all alike made the best time they could back to the next defensible section of the ground, and in view of the cautious timidity of the assailants, its occupation generally put a stop to the pursuit.

Taken all in all, the battles of this epoch were mostly of the "parallel" order, in which both sides mutually wear one another out in purely frontal attacks, and the side which could boast of the greatest endurance and courage, together with the best discipline, ultimately conquered. Occasionally the timely co-operation of a turning column turned the scale; but more frequently the idea was to "surprise" victory by attacking an enemy whilst passing a defile, rather than by directing the strength of the army against its adversary's weakness to "compel" victory.

Great leaders, such as Prince Eugene and Marlborough, fully understood both courses; but in long successions of battles, in Louis XIV's time, they stood alone in their art and tactical genius. The others adhered more and more, as time went on, to the hard and fast rules of the game—a proceeding which, in case of disaster, relieved them of *personal responsibility*.

"Thus the tactical science of the epoch had on the whole evolved the form best suited to the characteristics of armies of the period and their weapons, viz., the closed line as principal supporter of the fire fight; but the form had tended towards solidification, and showed itself rigid and incapable of adaptation to circumstances. A false conception of the condition on which success depended had led the minds of tacticians of the day astray in a search after the unattainable, viz., a normal form of action equally adaptable to all conditions. What in the hands of the masters was 'art' in its highest form, in the hands of their disciples became pure 'rule of thumb'—a characteristic tendency of the time which will be found to repeat itself also in the strategy of the same period."

The Strategy, or Method of conducting War.—Apart from the influence of the personality of the leaders and the mental evolution of the troops, the method of conducting war in all periods is conditioned by the politics, the system of supply, the roads or other lines of communication, and the recruiting and tactics of the armies employed.

The political circumstances of the Louis XIV period led to the formation of numerous coalitions, held together by their momentary common interests; and, as these varied, the elements of the coalition also varied; nations fighting one campaign on one side, the next on the other, according as they thought to perceive that their interests lay. Further, besides the interests of the State, a number of other personal considerations had to be taken into account. Dynastic interests, unworthy passions of rulers and their favourites, intrigues in the court parties on either side, sometimes played a decisive part. Thus alliances were lightly entered into, and as lightly broken. Further, diplomacy exercised its influence not only in the stages of operations preceding actual contact, but even made itself felt in the field itself. The result was to weaken the energy with which military operations were conducted. The constant consideration for the wishes of the allies, the striving to induce the enemy's allies to change sides, the fear lest neutral parties should join in—all led to the result that the combatants rarely put out their full fighting strength. To destroy the enemy and compel him to accept peace at any price ceased to be the leading idea; on the contrary, the highest art lay in entangling him diplomatically; and at last it came to this, that war was only carried on nominally; and a farther consequence was, that almost every treaty of peace contained in itself the seed of fresh discussions.

By the side of politics, the method of supply also had its influence. In the 30 years' war armies had lived exclusively on requisitions, and in doing so had proceeded to such excesses that war meant utter desolation to the tract wherein it was waged. In the following period as a reaction, an altogether exaggerated idea of the rights of private property prevailed; at the same time, the custom of always marching and camping the armies concentrated as a whole, brought more men together on the same ground than the resources of the farms and villages in the vicinity could supply. One was, therefore, compelled to provide for the troops out of one's own

means, and therefore, in advancing, to drag supplies after one; only forage for the horses was obtained on the spot or brought in by foraging parties, for, with the very considerable numbers of cavalry, sufficient wagon trains were not available. Hence magazines and bakeries had to be provided, and these magazines had to be moved up step by step with the progress of the armies. If the magazine system broke down nothing was left but supply by requisitions, which, for reasons above given, rarely sufficed, and since in those days irregularity in the feeding of troops led to desertion *en masse*, supply played an altogether disproportionate part in the regulation of the marches to what it does nowadays in European warfare.

The condition and nature of the roads by which the supplies were brought up and the troops moved must also be borne in recollection.

The post roads were generally some 11 yds. in width, and mostly of the same nature as the surrounding country from which they were frequently not even marked off by ditches or rows of trees. To keep them in order was the duty of the landowners through whose estates they passed, and they usually confined themselves to pitching down an occasional cart-load of stones, or throwing in a few faggots of brushwood when the state of things became intolerable; but no supervision existed to see that even this was done, only, if things were very bad, the traveller had a right to diverge into the fields and turn the obstacle as best he could. The construction of the great high roads was only taken in hand during the second half of the 18th century, but was then rapidly proceeded with; so that Napoleon found ready to his hand a wide-spread network of well-constructed roads, which alone rendered much of his strategy possible. Things were, of course, much more favourable when great rivers were available as lines of communication, and hence the importance attached to operating, where possible, along the valleys of such rivers as the Danube, the Po, the Rhine, &c.—an importance which, long after the conditions have changed against them, still leads sometimes to misconception as to their value.

As regards the influence that recruiting and completion of the armies had on their employment, it must be borne in mind that the standing armies of this period were on the whole, bodies of men entirely detached from the civilian population—always ready for the war purposes of their king. The Prussian army had carried out this idea to its logical conclusion further than any other, and alone was independent of militia drafts to complete it to a war footing.

But the difficulty was to supply the losses caused by war, by trained men, and the immense expense of maintenance in peace.

Each trained man, in fact, represented so much capital, and considerations of economy therefore modified the daring of the leaders, and also tended to an excess of caution in tactics, and led to an excessive value being attached to the defensive and the use of entrenchments.

All these influences exercised a retarding effect on the plans of campaign, which, as a rule, were not worked out by the Commander-in-Chief destined to execute them, but by the diplomatists who sought

to draft them in such a manner that the private interests of allies were equally well protected, and this naturally led to a dispersion of force all over the frontiers, instead of its concentration on the decisive point.

It will be evident, therefore, how great the advantage was when the king in person drew up his own plans and carried them into execution, and still more so when, as in the case of Napoleon, the conditions of the country placed him at the head of a nation in arms and rendered him indifferent to the expenditure of human life.

"These diplomatic negotiations frequently dragged on for months, so that the best opportunity for action was often allowed to slip. . . . When at last the contracting parties were agreed as to their several shares in the coming campaign, then each court drew up its own plan of operations, in which the general-in-chief might or might not be consulted, but on whom no real responsibility rested; and when this was finally entrusted into his hands for execution it was practically never omitted to caution him specially to take the utmost care not to risk his expensive army, and in all cases of difficulty to call in his subordinates for council. It is obvious what difficulties such a method of procedure entailed and how inevitably the energy of the war was crippled, and only occasionally we find men of exceptional ability such as Marlborough and Prince Eugene, with here and there momentarily a marshal of France breaking the bonds that held him, and acquiring a certain degree of respect for his own individuality."

As a rule the objective of the campaign was a province or frontier fortress, *never* the enemy's field army. This being settled, the next thing was to accumulate the magazines on which to base the movement. Then followed the march into the enemy's country, which, owing to bad roads and the enormous train, frequently was of extreme slowness. Ten English miles a day was considered exceptional, and often four to five was a fair average performance.

When the assailant had thus penetrated a few miles into the enemy's country, generally to some previously agreed on line of defence, a halt had to be made to bring up the bakeries and magazines, and these had then to be protected by detachments, and since no organised "*etappen*," *i.e.*, line of communication troops existed, the advancing army rapidly became weaker, and when the enemy was at last reached it was only considered advisable to attack if the latter was evidently surprised in his concentration; otherwise manœuvring was resorted to.

Even when a battle had been risked and won, the destruction of the enemy's field army was far from being attained, for, owing to want of energy in the pursuit, the adversary had generally ample opportunity to recover himself, and then reappeared on the theatre of war again, and *not without good prospect of results, for the attacking party had meanwhile probably turned itself against the frontier fortifications.*

The system of defence was on a par with that of the attack. As a rule, all available troops, *i.e.*, available after a host of points of secondary importance had been attended to, were united in a central

defensive position, where they awaited the attack, and, if manœuvred out of it, then they fell back to another.

To these positions great importance was attached, and they were previously reconnoitred and often fortified provisionally on a large scale in war; but it is fair to say that several of the best men were strongly against them, and pointed out the drawbacks inherent in them.

From all the aforesaid reasons the chief characteristic of the wars of those days were "positions and manœuvres, avoiding, as far as possible, the decision of battle," and, as a rule, the attack usually did come to a stand before these defences, for the fire power was already sufficient to make the success of a direct assault pretty uncertain, more especially owing to the absence of a sufficient artillery power to prepare the way. The assailant then deployed opposite to the defender, and formally "offered him battle," an offer not often accepted; or, if roads permitted, sought to frighten him out of his position by threatening a flank. If neither succeeded, then both sides entrenched themselves and endeavoured to starve each other out, or to induce each other by diversions to disperse their force, and then attack before these could be called in again.

Generally the tendency was to avoid fighting; the destruction of the enemy's field army was not the object of the war, only the occupation of a province or fortress, and manœuvres sufficed for the attainment of this without incurring the risk of a battle.

Many reasons gave an apparent justification of these views: first of these was the necessity of economising the troops. Battles, owing to the tactics of the day, were very bloody, and the losses very difficult to replace; and further, the issue of a fight depended more on chance than in the present day, owing to the want of adaptability to circumstances in the troops themselves, due to deficient military education, and still more often to the petty jealousies of the subordinate leaders. The results of a battle were also too small owing to the tardiness of pursuit rendered necessary both by the tactics and conditions of supply, and finally, whilst all the glory of a successful manœuvre belonged of right to the leader, the credit of a victorious battle fell to the troops almost entirely, the leader being liable to blame for sacrificing his men.

The above does not pretend to be a verbal translation of the whole of the chapters referred to, space alone would utterly forbid the attempt. But it gives all the main points, and more especially the spirit of the original. The point I wish to notice is the influence which this old-fashioned school of thought has had on the evolution of existing conceptions of strategy, more especially in our own service. It was from the writers of those days that Frederic's generals, and the bulk of his officers who studied at all, derived their ideas—and though he himself broke with the system as far as his conditions allowed him, and was never afraid to trust all to the decision of the battle, yet his absorption of all duties in himself, and habit of keeping his instructions secret, accessible only to the few and not to the army at large, resulted on his death in the resur-

rection of the old ideas; and thus when the revolution broke out, and the armed nation it produced gave Napoleon a weapon such as no other general in Europe could boast of, the Prussians were in as unfavourable a position to encounter him as the rest of the Powers who had had no Frederic to boast of. What need for wonder, therefore, at his astounding successes? But the evil of these mistaken notions did not die here. Writers, not soldiers, then attempted to explain Napoleon and Frederic's victories in conformity with the old traditions, and this was more especially the case in France, from whom again we have always borrowed most largely. There is an excuse for this retrogression, more especially in our case, for, except in Prussia, during the long peace, the idea of the standing army was everywhere revived, and with it came the need of economy of lives in battle, which gives a specious appearance of correctness to the idea of manœuvring, as against fighting, strategy, and which also prepared the way for the ready acceptance of the doctrine that the chief object of the training of troops for war is to teach them how to avoid getting killed and not how to kill.

The main difference between the conditions then and now which requires to be brought home to the public, more particularly as regards England, and possible European war, is this, that, whereas in those days three things were necessary for success, viz., "money," "money," and "more money," for money could buy men, as we know from experience: now it is "men" "money," and "more men," for though money is necessary for armament and supply, it can no longer buy men.

But the whole conception of modern war is based on a ruthless expenditure of life to gain certain ends, quite as much on the line of march, and indeed more so, than in the field, for there skilful massing at the right place and time, the mutual support of the three arms, and a training in discipline in peace so thorough that troops can be counted on to face even the heaviest losses when ordered to, still enable great results to be obtained with a small total expenditure of men, though locally the losses may amount to annihilation; but to ensure the arrival of the men at the right time and places may entail losses on the line of march far exceeding in the aggregate those incurred in the field. This utter ruthlessness with regard to the suffering of the individual was the true mainspring of Napoleonic strategy, and alone rendered his battle policy possible. Frederic and Wellington were both too much hampered by the money value of their soldiers to dare to emulate his feats in this respect.

ELECTRIC LIGHT PROJECTORS FOR COAST DEFENCE.

(Translated from the "Rivista Marittima" for January, 1894, by
T. J. HADDY, R.N.)

General Remarks.—When the electric light projectors were introduced on board ships with a view of discovering the enemy and guarding against sudden and secret attacks by torpedo-boats, many other useful applications were found for them, and it would appear that one of the most important of these is the defence of the coast, for which service they were very soon appropriated, so that at present we may say there is not a single harbour of any importance in the defence of which a certain number of projectors are not employed, and which are generally of a more powerful description than those fitted on board ships.

Although many years have passed since their introduction, and numerous experiments and accurate researches have been made by the principal navies of the world, we cannot but admit that even now great uncertainty still exists in the opinion of the most competent judges, both as regards the value of this arm of the defence and the best method of employing it. It is very certain, however, that the ranks of its adversaries have been constantly increasing, and have now become most formidable. They do not as yet call for its abolition, but assert however most positively, that the projectors should not be used on board ship except in special cases, and that the unconditional employment of them instead of being useful is always exceedingly dangerous. These are serious questions, which deserve the most accurate study and the fullest enquiry, and which would perhaps lead to results which would be indisputable, when we consider that, unlike other arms, they can be tested under conditions almost identical with those which would obtain in real warfare. The projectors destined for coast defence certainly merit the same attention as those which are carried on board ships.

Necessity for various kinds of Projectors.—The projectors for coast defence are employed under more favourable conditions than others, for the following reasons:—1st. They can nearly always be placed at a distance from the fort or battery the target of which they are called on to illuminate, and so that the position of the observer is the most favourable one possible. 2nd. They are not subject to restrictions of weight and space, and can consequently be more powerful than those on board ship, with increased efficiency. 3rd. For the reasons stated above, an arrangement can be adopted which affords protection for the engine and dynamo, the conductors, and also in

part for the projector, leaving only the lens itself exposed. In certain cases the latter could also be protected, and the luminous rays still usefully employed. The conditions by which the number of projectors on board ship is limited do not exist on shore, where the number can be determined in accordance with the necessities of the locality it is wished to defend. We may, therefore, allow ourselves to be guided in the determination of this question entirely by the considerations which we will bring forward. We consider that a projector cannot be expected to yield satisfactory service unless a well-defined task is assigned to it, clear and precise in every circumstance; and considering the numerous services which are required of projectors in the defence of a harbour or roadstead, we should apply to them the principle of the division of labour. We shall then have projectors for the protection and working of the obstructive defences, those for searching the horizon, and finally those destined for illuminating the ships of the enemy when discovered, in order that the guns of the forts may be brought to bear on them. With a view of clearness we shall name these three descriptions of projectors—mining, exploring, and aiming projectors. The first will illuminate the launches, torpedo-boats, and small vessels which may attempt to interfere with the obstructions, so as to keep them under the fire of the batteries told off for the protection of these obstructions, and also to show up any ships which may attempt the passes protected by observation mines, so that the latter may be exploded at the proper instant. It will be seen at once that the duties entrusted to these projectors are sufficiently numerous and important, and that the efficient performance of them would be seriously compromised if the duty of exploring the horizon were to be added. Indeed, if these two services were to be entrusted to one single series of projectors, the enemy's ships might, by drawing attention to themselves, monopolise their action, and so leave a free field for swift launches and torpedo-boats to play havoc with the obstructions by means of grapnels, small torpedoes, &c. By showing themselves for short and flying intervals at a distance of 4,000 metres from the projectors, the ships would be visible with difficulty and very indistinctly, and the defensive batteries would hardly risk a shot at them from the great uncertainty of aim they would have. If the times of their appearance were well chosen, and the atmospheric conditions favourable to them, fast ships would have very little to fear from the attacks of the torpedo-boats of the mobile defence.

There is also another reason for the institution of the first two kinds of projectors; we shall see presently that with a given position of battery, observing station for mine field, launching station for torpedoes, &c., there is a certain position for the projector detailed to discover the target within the field of action covered by those works, which is distinctly preferable to any other; and since forts, observing stations, &c., have different positions and fields of action it follows that a projector should be attached to each for exploring services. If, however, the various works of defence are so close to each other that they may be considered as a whole, and all operate on the

same zone of the sea, a single projector may be sufficient; this, however, cannot be the case with forts (which nearly always have a very extended field of action), in conjunction with groups of batteries for the defence of the obstructions, observing and launching stations, &c., which have a field of action more internal and limited, hence the necessity of having the two systems of projectors before named. Besides this, it is very certain that searching the horizon by the projectors destined for this service would have to be continued after an enemy's ship had been discovered, hence the necessity that the fort or group of forts commanding the zone in which the ship is discovered should have a projector attached exclusively to this fort or group of forts so as to keep their target constantly illuminated, and at the same time leave the work of exploration to be carried on by the projector detailed for that service. The reason which justifies the existence of these aiming projectors is as follows:—

Projectors for the Obstructive Defences.—Let A B (Fig. 1) represent a mine field, and C its protecting battery, with this single and well-defined duty only, G C H being the field of action which its guns command; this limitation permits of the protection of the battery from the guns of the enemy's ships in the offing by the earthwork or armoured parapet D; the same advantage may be obtained in the protection of the projectors when their duties are confined solely to the surveillance of the obstructions themselves; they may therefore, for example, be installed at P, and will illuminate the zone E P F, which includes, in addition to the mine field A B, a zone Z in front of it, and such that the least distance $a b$ between the external radius P E of the sector to be explored and the first line of the mine field is at least 1,000 metres. In this way before the boats and light vessels could reach the mine fields and be in a position to do them injury they would be a sufficient time under the fire of the protecting battery; or, in the case of an observation mine, the officer at the observing station would have plenty of time to discover and follow the enemy's ship while she is still at some distance from the mine which it is his duty to explode. The projector would be defended by the armoured parapet K from the guns of the enemy's ships in the open, and from which also by its keeping the source of light out of sight a good object of aim would be withdrawn. It might be objected that a projector so installed might be surprised by launches or torpedo-boats and destroyed, as they could approach in the sector E P L not covered by the light; for this reason an attentive and vigilant service of guard-boats and coast defence torpedo-boats would be exercised in the dark zone, and which would constitute the mobile defence outside the obstructive defences; the steamboats not being disturbed by the electric light would perform a service of discovery really efficient, and would engage the boats of the enemy which might attempt to interfere with the obstructive defences. A few machine-guns in the neighbourhood of the projectors would defend the approaches both from the sea and shore against any enemy rash enough to attempt to take them by surprise by a night attack.

Exploring and Aiming Projectors.—The exploring and aiming pro-

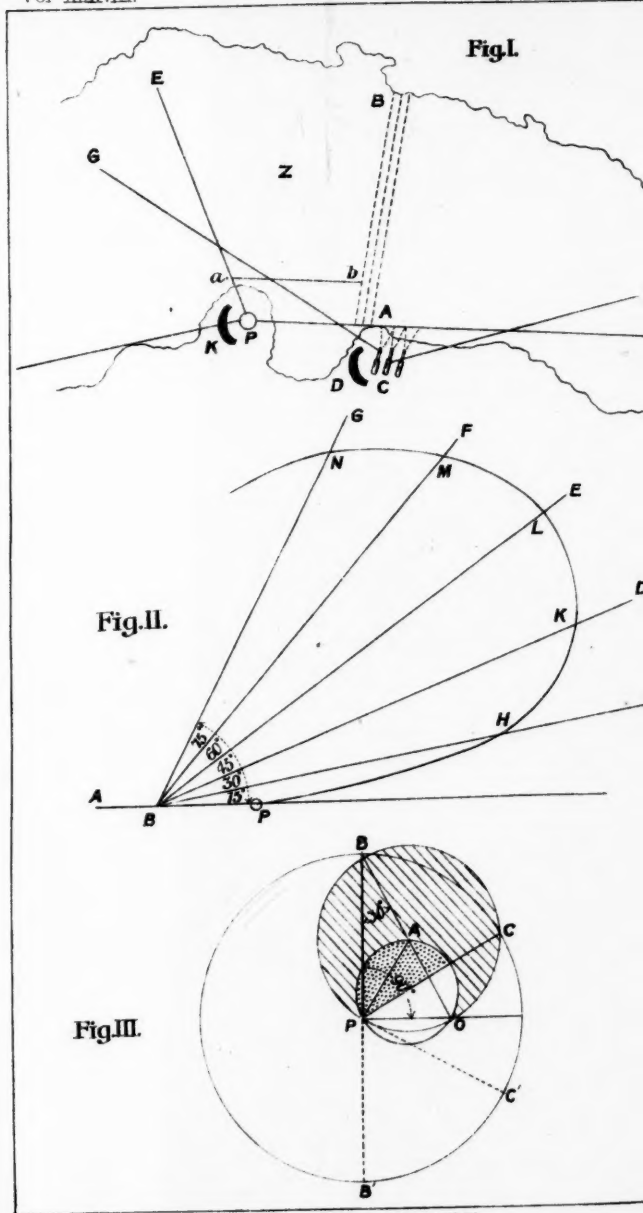
jectors are more subject to destruction by the guns of the torpedo-boats and light ships of the enemy in virtue of their exposed position. They should therefore be protected as much as possible; they should never be so installed as to be exposed to direct attack, by which I mean to the destructive effects of projectiles falling in their immediate vicinity; they should not therefore be placed on ramparts of masonry, neither inside nor in the neighbourhood of old churches, castles, towers, &c., where they would run the risk of being buried in the ruins caused by shell fire, and never so that there are walls behind and above them.

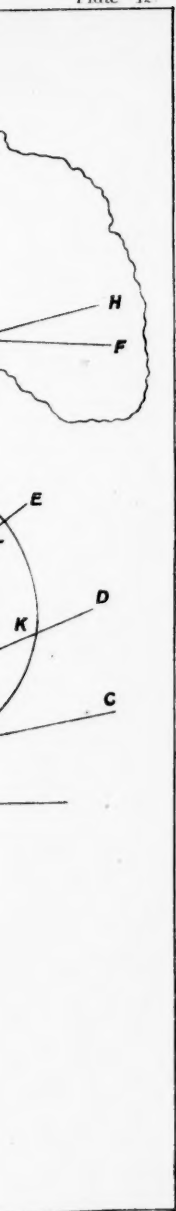
The projector should be protected by an armoured parapet or other defence in such a way that the lens alone, from which the beam of light issues, remains unprotected from the shots of the enemy. An armour-shield similar to that employed for the protection of light guns moving with the projector, and provided with suitable apertures, would serve to protect it and also the operator as well. A disappearing installation will also give good results when arranged so that it allows of the projector being worked under cover, leaving only the reflecting mirror exposed. In determining the position on shore for the projectors for the defence, care should be taken that in working the light for searching purposes the beam does not fall on any of the other defensive works, as this would not only render them visible to the enemy, but would also place the gunners and every other observer in the worst possible condition for carrying out their duties. The alternation of dazzling light and almost total darkness, injurious to all, would be exceptionally so for the officers in charge of the observation mines, as they would be able to see nothing beyond their own immediate surroundings. It would be a grave error too to place a projector inside a battery, from the disturbing effect it would have on the aiming of the guns in certain positions of the beam, besides which it would afford the enemy a good target and enable them to direct their own guns on the battery. Here we might consider (although we have not much practical experience to go upon) that the aim against a projector would always be a very certain one since the gunner, if provided with suitable coloured glasses, could see and keep the sights on the source of light, even when it is turned directly against him.

Curve of Visibility.—Choice of the Locality in which to establish the Electric Light Station.—It does not need a long argument to show that nothing disturbs an observer more than a source of light close at hand, and which strongly illuminates the objects in his immediate vicinity when he is intent on discovering objects at a distance. For this reason a position near to the electric light projector is an unfavourable one for an observer; we can therefore assert so far that a projector should be placed at a distance from the works whose target it is its duty to illuminate; but on what bearing? Let P, fig. 2, be the electric light projector, PA the direction of its beam, and let us make PA fall on any target whatever, keeping the axis of the illuminating cone constantly on it; for example, at B; an observer situated at P, near to the projector, would then lose sight of the

target; let the same observer, starting from B, take the various directions BC, BD, BE, BF, BG, &c., making with PB the angles $PBC = 15^\circ$, $PBD = 30^\circ$, $PBE = 45^\circ$, $PBF = 60^\circ$, $PBG = 75^\circ$, &c., and determine the different points H, K, L, M, N, &c., at which he loses sight of the target; by joining these different points we shall obtain a curve which we may call the curve of visibility. We shall find that the curve KLM approximates very closely to an arc of a circle having its centre at B, and the radius $BK = BL = BM$ equal to about six times PB, the distance between the projector and the target. This is the only experiment as regard the researches for data in the employment of the electric light which has a general character; the results always verify each other under any atmospheric conditions, and independently of the observer or of the material employed; the only condition necessary is that all the other conditions remain constant during the period of the experiment. From this we may draw the conclusion that the most advantageous position for an observer with respect to a target illuminated by the electric light is such that the line drawn from his position to the target makes an angle of from 30° to 60° with the beam of the projector. It is not to be concluded that to maintain this favourable position will necessitate a considerable limitation of the zone of exploration. For example, let us construct (in fig. 3) a right angle triangle at PBPO, the base BP = 3,500 metres (the maximum range of exploration), the angle $PBO = 30^\circ$, and let us suppose the projector at P, the target at B, and the observer at O; describe a circle passing through the three points B, P, O; it will have its centre at A, the middle point of the hypotenuse BO, and PAO will be 60° . Let us describe a second circle through P, A, O; now, for all the points comprised within the figure in hatched lines, the straight lines from them to P and O will form angles varying from 30° to 60° ; for those comprised within the figure in dotted lines the above conditions will not hold good, but when we consider that their greater proximity to the projector will more than compensate for the unfavourable conditions in which they are placed, we shall see at once that they may also be included in the sector of exploration, which will result in this sector BPC being equal to 60° ; which is sufficient as we shall see hereafter in considering other conditions which limit its extent to a range not greater than this; the positions of the observer and projector being fixed we shall have another sector B'PC' similar to the first. It is very certain that the reasons for deciding the choice of position for an electric light installation will be so many and various that we shall be obliged to take only a relative account of all that we have brought forward. In order to fix the position of the projector for any defensive work it is necessary to determine its range, to do which would require numerous and difficult experiments, and in carrying them out we should have to take account of most variable conditions, and which it would not be possible to include in our calculations by the substitution of any coefficient whatever, as, for example, the state of the sea and atmosphere, the height of the projector above the sea level, the nature and colour of the target, and

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the manner in which it is presented, &c. We may say, therefore, that the projector has no fixed range, as any of the above causes would be sufficient to modify it; besides which, as we see on the first experiment of which we treated, the position of the observer influences the effective range of the projector; it is clear, then, that in this particular it is impossible to obtain data of a precise and general character, but if we had the results of numerous and patient researches to guide us, we might be able to deduce from them consequences of the greatest advantage to us. I maintain, in conclusion, that it is absolutely useless to extend observations beyond a range of 3,500 metres for projectors of 90 cm. (36 in.) and 70 ampères, which are the prototype of those used for coast defence. The rapidity with which the efficiency of the projector diminishes with increased distance from the object it illuminates is well known, and must be taken into account when choosing the site for the installation of a search light installation; we cannot, therefore, think of placing the observer nearer to the target than the projector is; which principle applies also to the defensive works.

Both the projectors for the protection of the obstructions and those for discovering the enemy's ships must be situated at the least possible elevation above the sea; for whilst it is of the greatest advantage on the one hand to preserve the inclination of the beam to the horizon constant, yet, on the other, it is obviously desirable to leave the dark zone near the coast immediately under the beam as small as possible in extent, and it is therefore clear that the lowest elevation is the best; in practice, however, we must adopt a position which protects the projector from the wash of the sea or spray during bad weather. For projectors which serve to illuminate the targets for the heavy artillery the same conditions do not hold as for the others, and for them the greatest elevation possible is to be preferred. The intersection of the beam and the ship illuminated will, in this way, result in a larger area of illumination, and it will increase with the increase of the angle of incidence and with the increase of elevation of the projector; more than this we shall have in the projection of the beam the illuminated surface of the upper deck of the ship, which is generally light in colour, and will increase the visibility of the target from the batteries.

Method of using Projectors for Coast Defence Purposes.—The greatest uncertainty still exists amongst the most competent judges on the employment and arrangement of projectors for harbour defence, but from what we have stated in this article, one thing is clearly manifest, and that is, that any method of using a projector would be preferable to that which leaves it in the hands of the person who operates the working apparatus, that is, who is placed in the immediate vicinity of the source of light; to this, however, we are forced to submit when the projector is not in communication with an observer conveniently situated. An ideal arrangement would be that which would permit the observer himself to work the apparatus when placed at a distance from it, but in default of this we must have recourse to the telegraph or telephone, as it is evident that

instantaneous transmission is required in order to control a projector efficiently from a distance; the telegraph is, therefore, advisable only as a safe method of communication and which leaves a register of itself, but it does not answer the conditions. There is no doubt but that the telephone must be adopted; the receiver must be situated in a quiet place so as to avoid repetitions, which would cause a loss of time and make the connection itself useless. Close to every electric light station there should be a chamber, which should also serve as the storage room for the projector, in which all the telephonic communications should be collected; the attendant receiving the messages at the telephone should transmit the orders to the person in charge of the training and elevating gear at the projector, either by calling them out loudly, or by means of a voice tube; in the same chamber there should be an observer for the illuminated zone, to assist the one stationed at a distance in giving instructions to the man working the projector. The principal services which may be assigned to a projector are the following:—1st. To discover a ship within a given section of the horizon. 2nd. To follow the target with the beam of light. The best way to use a projector for the purpose of discovery is undoubtedly that in which a fixed depression calculated as a fraction of its height is given to the beam of light, and such that the inclination of the illuminating cone with the surface of the sea will produce an illuminated ellipse with its major axis in the line of the beam equal to 4,000 metres, and the projector should be worked with a uniform angular movement. The velocity of this movement should be such as to cause it to pass twice over any ship which might cross the zone commanded by the projector, in the direction of a chord of the sector, at a speed of 18 knots. If the extent of the sector is so great as to necessitate a too rapid angular movement of the projector, it should be divided between two, and for this reason as a rule the extent of the sector assigned to any single projector should not exceed 60° .

To follow an object when discovered with the projector does not offer any difficulty when the observer and the person working the apparatus is one and the same individual, but when this is not the case the operation becomes an exceedingly delicate one, and it is a bad case if there are two or more observers watching the target, and giving instructions to the man in charge of the light; there should be perfect accord between the observer and the latter, who should know exactly what is meant by the orders "easy," "smartly," &c., which necessitates constant exercise with a fixed personnel.

It is certain that a really efficient employment of projectors can only be obtained by having them controllable at a distance. Another important question arises, Should the projectors for harbour defences be kept continuously in action during the night? Admitting that the position of the electric light installations is perfectly known to the enemy, the continuous action of the projectors will carry with it the following disadvantages:—

1st. It will allow the enemy to reconnoitre from the offing every locality and prominent point, to determine his exact position on the

chart, and as a consequence the exact distance of the various defensive works.

2nd. Friendly guard-boats, torpedo-boats, and small vessels will be frequently under the light of the projectors, and whilst it would render their task of attack by surprise most difficult, it must often happen that they will form a most favourable illuminated target for the guns of the enemy's ships, and which they, surrounded with light, will not even be able to see; in other words, the movable defence (constituted almost entirely of torpedo-boats, a defence in which naval officers have very much more faith than in the fixed defences, and with good foundation for their confidence) would be obliged to carry out its duties under conditions absolutely unfavourable; when the particular local conditions do not admit of this danger being avoided, I think we need not hesitate to affirm that the projectors should *not* be kept continuously in action, but kept instantly, ready for use when the presence of the enemy is notified by the exploring ships or guard-boats.

In addition to keeping the projectors obscured, when we can also succeed in suppressing every light visible within a certain distance, such as from houses, lighthouses, factories, &c., on dark and rainy nights, which are just those in which isolated and limited attacks by surprise are most to be feared, we shall render the enemy uncertain and hesitating in his attack, and enable the boats of the mobile defence to operate under more favourable conditions. It may be objected that this obscurity will also be injurious to the ships of your own side in case it should be necessary for them to enter the protected harbour, but it must be admitted that their commanders will be more familiar with the locality than those of the enemy's ships; besides which it would be easy to establish a temporary light in a convenient position, which should only be shown when a ship, known to be friendly by means of private signals, requires to enter the harbour. The ships and torpedo-boats of the exploring service should be furnished with a 40-cm. (15 $\frac{3}{4}$ -in.) projector, ready for action but completely obscured, so that when the beam is thrown on the ship or boat discovered, it not only announces the fact of the discovery, but also the direction and nature of it. In order not to expose herself to certain and swift destruction, the light should be obscured every now and then, and a rapid change of position effected before again putting it in action; the ship could in this way be fought efficiently by the other torpedo-boats which would operate under cover of darkness; and if she should take to her heels again this will be the time to put into action the projector of the fixed defence, in order to show her up for attack by the batteries to which they are attached. The launches and guard-boats in the zone outside the obstructions should also be supplied with 35-cm. (13·8-in.) projectors, which they could use as above for discovering the enemy's torpedo-boats and small vessels which may invade their territory.

In conclusion, I consider that accurate study and patient research and experiment are still necessary on the subject of the installation and employment of projectors, and am convinced that the conclusions

arrived at would show that greater confidence should be placed in them, and that it is necessary to employ them much more largely than at present for the purposes of coast defence. It is certainly necessary to dispel all that is at present indeterminate and uncertain in the use of this particular arm of the service, which, seeing that it always and continuously reveals its presence at the same time as its efficiency, may easily become dangerous rather than useful to its friends.

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NAVAL AND MILITARY NOTES.

NAVAL.

Home.—Rear-Admiral Compton Domville has been selected to succeed Rear-Admiral Markham as second-in-command of the Mediterranean Fleet, and Captain Kane takes his place at the Admiralty as Director of Naval Ordnance. Rear-Admiral R. Duckworth-King succeeds Vice-Admiral Tracey in charge of the Dockyard at Malta.

The 3rd class cruiser "Melpomene," Captain Parr, has arrived at Portsmouth from the Pacific, and been paid off into the Fleet Reserve. The battle-ship "Centurion" has been commissioned at the same port, with a complement of 620 officers and men, as the new flag-ship in China; after a week's experimental cruise in the Channel, all being well, she leaves for her station.

The new 1st class gunboat "Speedy" has been commissioned at Chatham by Commander Elliott; she will proceed to Portsmouth to carry out a series of experimental trials, at the conclusion of which she is to be attached to the Channel Squadron for service as despatch vessel.

New crews for the 3rd class cruiser "Marathon," to which ship Captain Maconochie has been appointed, and for the 1st class gunboat "Lapwing," have gone out in the "Tyne" to Bombay, where the two vessels will be recommissioned. Similarly, new crews have been sent out in the "Tamar" to Hong Kong for the 3rd class cruiser "Porpoise," the sloop "Swift," and the gunboats "Rattler" and "Firebrand." The 1st class cruiser "Crescent" has been commissioned at Portsmouth by Captain Craigie, and will take out new crews for the 3rd class cruisers "Wallaroo" (to which Captain Graham has been appointed), "Ringarooma" (Captain Johnson), "Katoomba" (Captain Baker), and the 1st class gunboat "Karakatta," all of which vessels will be recommissioned at Sydney, the old crews returning to England in the "Crescent."

The following vessels have been passed into the A Division of the Fleet Reserve, and are now ready for commissioning:—The 1st class cruiser "Endymion" at Portsmouth, 2nd class cruisers, "Forth" (after repairs to damage caused by her collision) and "Bonaventure" at Plymouth, and the 1st class gunboats "Hebe," "Onyx," and "Renard" at Chatham.

Both the 2nd class cruisers, "Spartan" and "Æolus," commissioned for the Mediterranean, have made very successful three hours' commissioning full-power natural draught trials of their machinery; in both cases the contracted H.P. and speed was exceeded, as was the case when the ships made their trials on being completed for sea. With mean steam in boilers 146 lbs., air pressure 0.26 in., I.H.P. of 7,220, the "Spartan" averaged by log 18.5 knots, while the "Æolus," with a pressure in boilers of 142 lbs., air pressure 0.2 in., and I.H.P. 7,414, made an average of 18.2 knots. Both vessels, with the "Skipjack," have since left for their station.

The new 1st class gunboat "Renard," just completed for sea, is worthy of some mention, as better results were obtained at her steam trials than has yet been the case with other vessels of her type. With a length of 230 ft., a beam of 27 ft.,

she has a displacement of 810 tons. Her engines were estimated to develop 3,500 I.H.P., but, at her official trials off Sheerness, a maximum of 4,228 H.P. was recorded, with a mean of 3,962 H.P., or 462 H.P. in excess of the estimate, these results being obtained with the use of forced draught, and giving the vessel a speed of nearly 20 knots. Working under natural draught, her machinery develops 2,500 I.H.P., giving a speed of 17.7 knots. The armament of the "Renard" consists of two 4.7-in. and four 3-pounder Q.F. guns, with five torpedo-tubes—one in the bow and two on either side amidships. Her sister vessel, the "Hebe," also passed very successfully through her steam trials, averaging under natural draught 17.8 knots, with engines developing 2,700 I.H.P.; while under forced draught the engines developed 3,566 I.H.P., giving a corresponding speed of 19 knots, the contract providing for 2,500 I.H.P. under natural, and 3,500 under forced, draught. A further special trial was carried out to ascertain the highest H.P. obtainable without putting any undue strain upon her machinery, when a "maximum" of 4,201 I.H.P., and a mean of 3,923.3 I.H.P., was registered during a three hours' run.

The official trials of No. 93 torpedo-boat, the first of the new type of boat ordered in 1892, and the only one fitted with twin screws, were completed off Sheerness at the close of the year. At the first trial, with a steam pressure of 225 lbs. per sq. in., and the engines making 472 revolutions per minute, the vessel attained a speed of 23.8 knots. On the continuous three hours' trial, which took place on the 21st December, the mean revolutions of the engines per minute were 467, and the speed 23.5 knots. This new type of torpedo-boat has a length of 140 ft., an extreme breadth of 15 ft. 6 in., and her loaded draught is 5 ft. 4 in. She is fitted with triple-expansion three-cylinder engines, driving twin screws, and capable of developing 2,000 I.H.P., steam for which is supplied by two Thornycroft water-tube boilers. Her armament consists of three 3-pr. guns and three tubes for 18-in. torpedoes. It is as well, however, to draw attention to the fact that the speed of this new boat—and it is to be presumed of the nine others of her class not yet completed—is inferior to the speed of the French 147-ft. "Coureur," a boat built by the Thornycroft firm as far back as 1888, and is far below the speed of the latest types of French, Russian, Italian, and German boats of much the same dimensions and tonnage. In this connection it may be interesting to record the successful passage across the Atlantic, unconvoyed, of the five new 143-ft. torpedo-boats bought some four months ago from the Schichau firm, at Elbing, for the Brazilian Government, and which arrived safely at Pernambuco on the 26th January. They experienced very bad weather from the Eider Canal to Dartmouth, where they had to wait some time until the weather moderated sufficiently for them to cross the Bay. They coaled at Las Palmas and at St. Vincent, arriving at Pernambuco with a fair reserve of coal in their bunkers, having steamed with one boiler, which gave them a speed of 12 knots. The success of the voyage is important, if the facts are correctly reported, as showing that boats of this class can cross the Atlantic and be ready for action even before recoaling. These Schichau boats have a smooth-water speed of between 26 and 27 knots, and are practically identical with the Russian torpedo-boats of the "Adler" type, also built and building by this firm, two of which, at least, are destined for Vladivostok for service in the Pacific, with the five Italian boats of the "Aquila" type, and several of the newer German boats, and that, until the new catchers of the "Havock" class are completed, we possess no boats which can in any way compete with them.

In view of the fact that it is now recognised that if any important part of the double revolving torpedo-tube should become damaged, both tubes (and consequently almost the whole torpedo armament of one vessel) would be disabled, the Admiralty have decided to fit 14 of the new destroyers with two single revolving tubes, one of which will be mounted forward and the other as a stern tube.

The "St. George," the last of the nine 1st class protected cruisers laid down under the Naval Defence Act, made an eight hours' official trial of her machinery off Portsmouth on the 22nd January with natural draught. She is of 7,700 tons displacement, and differs from the majority of her class in being sheathed with

wood and copper. She was constructed and engineered by Earle's Shipbuilding Company, Hull. The designed load draught of the ship is 24 ft. 9 in., but her mean trial immersion was only 21 ft. 3½ in., or 19 ft. 4 in. forward and 23 ft. 3 in. aft. The average boiler pressure was 153·8 lbs., which was sustained by 0·09 in. of air pressure, with a mean coal consumption of 1·62 lbs. per horse-power. The vacuum was 27·7 in., and the revolutions 100 per minute. Under these conditions the engines developed 10,536 I.H.P., or over 500 more than the contract. The average speed obtained was 20·2 knots. The trial was in every respect successful. It is not intended to subject the "St. George" to a trial under forced draught. The only vessels of the class which have been steamed for "maximum" power are the "Grafton" and the "Edgar," of which the former developed 13,434 and the latter 13,260 I.H.P. with closed stokeholds.

The new 1st class battle-ship "Revenge" has completed her gunnery trials, and according to present arrangements, will relieve the "Rodney" in the Channel Squadron in April. The programme of the trials was essentially the same as those already carried out on board her sister ships the "Royal Sovereign," &c. The principal interest was centred on the after barbette, the right gun of which was experimentally mounted on a new and improved slide. The original Elswick arrangement, as fitted to the other heavy guns, consists of a single recoil cylinder, having a large number of spring roller valves attached at the rear of the recoil press. This system was considered objectionable on account of the liability of the valves to get out of order, and to permit the gun and carriage to recoil without control, and it was deemed advisable to substitute a simpler and more trustworthy arrangement with as few loaded valves as possible. It was therefore decided to apply what is known as the "pull and push" method, which requires two cylinders but a single loaded valve, which can readily be examined and adjusted as circumstances demand. The system, however, is only new in its application, as it is merely a development of the original Vavasseur mountings as first adopted in the Service. In the ships about to be built the "pull and push" system is to be still further simplified. Instead of two there will be only one recoil cylinder per gun, and the presses will not be interfered with, the running in being performed by the force of the recoil and the running out by means of springs. In the "Revenge" the running in of the gun on the slides is accomplished by the admission of water to one cylinder, and the running out by admitting it to the other. It may be mentioned that the principle of recoil presses fitted with valve keys is already extensively applied to small mountings.

Three rounds were fired from each gun in the after barbette with reduced and full charges (that is to say with 472½ lbs. and 630 lbs. of S.B.C. powder, with a projectile weighing 1,250 lbs.), and an extra round from the right gun with an extreme elevation of 13½°, for the purpose of securing a diagram of pressures. The new mounting was perfectly successful, the only noticeable feature being the fact that the length of the recoil was practically the same under the reduced as with full charges. With three-quarter charges the recoil of the right gun was 4 ft. 7½ in., and that of the left gun 4 ft. 7 in. With full charges the recoils of the two guns were substantially identical, that of the right gun being 4 ft. 8½ in. and of the left 4 ft. 8 in. when fired simultaneously with 10° of elevation. The difference is due to the application of different principles. In the hydraulic system the resistance behind the gun is already formed, and the length of the recoil varies with the charge, while under the bar system the resistance is generated by the recoil itself, and may be regarded as practically constant except as regards velocity. There were no miss-fires during the firing.

Good progress is being made at Chatham with the "Magnificent" and "Minerva," since a commencement was made with them at the latter end of November; the "Eclipse," at Portsmouth, is also well under way, but the first keel plates of the "Majestic," the sister-ship to the "Magnificent," were only laid down at that yard on the 5th February; while on the 1st March the blocks were

only being prepared at Devonport for laying down the "Talbot," yet these are the vessels which were all supposed to have been commenced before last August.

Two new 1st class torpedo-gunboats, the "Hazard" and "Harrier," were launched at Pembroke and Devonport on the 20th and 17th February respectively; they are sister-vessels to the "Dryad," lately launched at Chatham, and, as they have been launched with their engines and boilers on board, they ought to be ready for their trials in a very short time.

A new breakwater is about to be constructed at Portland about a mile and three-quarters in length, stretching from Bincleaves, Weymouth, to the present breakwater. It is expected that the new works will take some ten years to accomplish, and that the cost will be about 1,000,000*l.*; the work is to be done by contract. It has been found that the roadstead could not be made impregnable to the attacks of torpedo-boats, notwithstanding that booms were laid from the mainland across to the breakwater, with a view of rendering a fleet anchored in the roadstead secure from such an attack. It is proposed to run a breakwater from the shore on the Weymouth side into deep water, erecting pillars of masonry at a distance of 600 or 800 yards, so that in case of war these could be "boomed," thereby preventing an enemy's torpedo fleet entering the harbour. Ultimately a permanent breakwater will be erected in the spaces between the pillars, thus connecting the new structure with the old one. Situated as Portland is, midway between Plymouth and Portsmouth, the harbour of refuge will be one of great strategic importance, and as a pier is now almost completed there, by which the coaling of the fleet will be much expedited, and Messrs. Whitehead & Co.'s extensive torpedo works have been erected in the immediate vicinity, the Admiralty have no doubt thought it expedient to take some additional measures for the defence of the harbour.

The new mole at Gibraltar is to be lengthened 800 ft., and the work has been commenced; it is being carried out by contract.

We regret very much to have to chronicle that the Naval Brigade, which has been operating on the Gambia against Fodi Silah, an important Mahomedan slave-hunter, has met with a serious reverse, 3 officers and 14 men being killed, 2 officers and 5 men dangerously, and 3 officers and 40 men slightly wounded.

It appears that a force of 200 officers and men from the "Raleigh," "Widgeon," and "Magpie," with a field gun, were landed under the command of Captain Gamble of the "Raleigh," on February 22, to attack and destroy some of the Chief's stockaded villages; on returning to the boats the following day, according to the report, they fell into an ambush, and were forced to re-embark, after sustaining the heavy loss mentioned above, and being also unable to bring off the field gun. The officers killed were—Lieutenant Arnold, "Raleigh"; Lieutenant Hervey, R.M.L.I., "Raleigh"; and Sub-Lieutenant Meister of the "Magpie"; Lieutenants Boyle and Saville of "Raleigh" dangerously wounded.

France.—Rear-Admiral Maigret has been appointed to the command of the Training Squadron in succession to Rear-Admiral Sallandrouze de Lamornaix; he will hoist his flag on board the "Naïade" on the 15th March, Capitaine de Vaisseau Antoine being his Chief of the Staff. Rear-Admiral Roustan, who was one of the New Year's promotions, succeeds Admiral Maigret at the Ministry of Marine as "Director of the Personnel." He is well known to many English officers, having held the post of Naval Attaché in London for some years. Capitaine de Vaisseau Bienaimé has been appointed senior officer in command of the East Indian Naval Division, and hoists his broad-pendant on board the 1st class cruiser "Primauguet." The Committee of Inspector-Generals of the Fleet is now composed of the following officers:—Vice-Admirals Rieunier (president), Alquier, Dorlodot des Essarts, and Rear-Admiral Dieulonard as Inspector-Generals; Capitaines de Vaisseau

Boulineau, de Montesquieu, and Michel as assistants; M. Roussar secretary, and Capitaine de Frégate Paupée aide-de-camp of the President of the Committee.
(“Le Petit Var.”)

In last month's notes we gave a list of all warships launched during the year 1893; we now give a complete list of all vessels at present under construction for the French Navy or contemplated in the Budget proposals for 1894. This list is taken from the “Journal Officiel de la République Française” of December 25th, 1893, but has been so far corrected, that the names of some of the new ships, represented in the official return by numbers only, and which have since been given, have been added, and the return itself may prove useful for purposes of reference.

A. Ships under construction or about to be commenced in the dockyards:—Battle-ships—“Brennus,” “Charles-Martel,” “Lazare-Carnot,” “Bouvet,” “Charlemagne,” “Saint-Louis.” Coast defence battle-ship—“Tréhouart.” 1st class armoured cruisers—“Charner,” “Bruix.” 2nd class cruisers—“Pascal,” “Suchet,” “Bugeaud,” “Chasseloup-Laubat,” “Friant,” “Du Chayla,” “G 4.” 3rd class cruisers—“Galilée,” “Lavoisier.” Aviso transport—“Vaucluse.” Submarine boat—“Morse.”

B. Certain other vessels nearly completed, but still requiring some further expenditure:—Battle-ship—“Magenta.” 1st class armoured cruiser—“Dupuy-Lôme.” 1st class cruiser—“Isly.” Torpedo cruiser—“Fleurus.” Submarine boat—“Gustave-Zédé.”

The total credit asked for the expenditure during the year 1894 on the foregoing vessels in lists A and B is 33,970,918 francs.

C. Ships building or immediately to be built by contract:—Battle-ships—“Jauréguiberry,” “Masséna,” “Henri IV.” 1st class armoured cruisers—“Chanzy,” “Latouche-Tréville,” “Pothuau.” 1st class cruisers—“D'Entrecasteaux,” “Jeanne d'Arc.” 2nd class cruisers—“Descartes,” “P,” “D'Assas,” “E 4,” “E 5,” “E 6,” “G 3.” 3rd class cruiser—“Linois.” Cruiser torpedo-depôt ship—“Foudre.” 2nd class aviso—“U 1.” Aviso-torpilleurs—“Cassini,” “Casabianca.” Gun-boat—“Surprise.” Special service—“Onyx,” “X 2,” “X 3.” Torpilleurs-de-haute-mer—“Flibustier,” “Ariel,” “Tourmente,” “Argonaute,” “Averne,” “Dauphin,” “Aiglon,” “Ténaire,” “Cerbère,” “Forban,” and “N 12.” 1st class torpedo-boats—180—181, 182—187, 188—191, 192—194, 195—198, 199—200, “P 20” to “P 24.” 2nd class torpedo-boats—“Q 1” to “Q 4.” Torpedo-boats to be carried in ships—“A,” “B,” “R 3” to “R 9.” Submarine boat—“Goubet.”

D. Certain other vessels building by contract and now nearly completed, but still requiring some further expenditure:—3rd class cruiser—“Cosillogon.” Torpilleurs-de-haute-mer—“Chevalier,” “Corsaire,” “Mousquetaire.” 1st class torpedo-boats—170—171. The total credit asked for the expenditure during the year 1894 on vessels in lists C and D is 35,669,000 francs.

E. Supplementary list of ships building by contract, and to be nearly completed in 1894:—Coast-defence battle-ships—“Jemmapes,” “Bouvines,” “Valmy.” Torpedo-aviso—“D'Iberville.” Torpilleur-de-haute-mer—“Lansquenec.”

The credit asked for the virtual completion of the vessels in List E is 6,600,000 francs. Thus the total expenditure on new construction will amount in 1894 in round numbers to 76,240,000 francs, or 3,060,000*l.* sterling. It will be seen from the foregoing lists that France has actually under construction or in immediate contemplation no less than 10 1st class battle-ships, four so-called coast-defence battle-ships, six 1st class armoured cruisers, four 1st class protected cruisers, 14 2nd class cruisers, and four 3rd class cruisers, without reckoning a large number of smaller craft of various descriptions, and a considerable flotilla of torpedo-boats.

The following was the condition of work at the five naval arsenals on January 1st:—At Cherbourg the “Du Chayla” was building, and the “D'Assas” was preparing to build; the “Chasseloup-Loubat,” “Bugeaud,” “Latouche-Tréville,” and “Fleurus” were being completed afloat; the “Archer” and “Chevalier” were undergoing trials; and the “Surcouf” and “Troude” were undergoing repair. At Brest the “Charlemagne” and a cruiser of the “Galilée” type were preparing to build; the “Friant,” “Charles-Martel,” and “Jemmapes” were completing

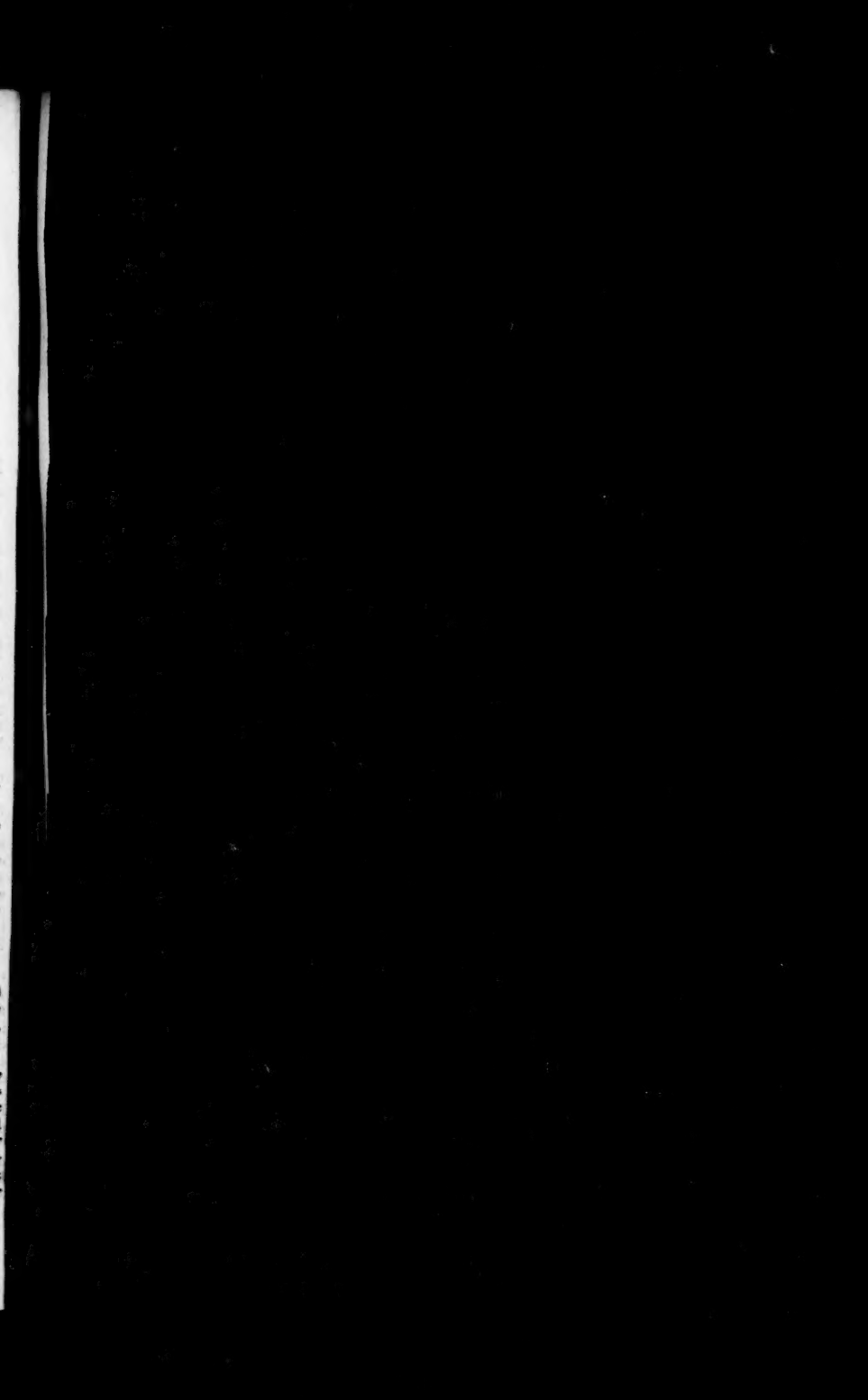
afoat; and the "Dupuy-de-Lôme," "Cœtlogon," "Épervier," and "Lansquenet" were undergoing trials or repairs. At Lorient the "Bouvet" was building, and the "Saint-Louis" was preparing to build; the "Brennus" and "Tréhouart" were completing afoat; and the "Duquesne," "Rance," "Tourmente," and "Argonaute" were undergoing trials or repairs. At Rochefort the "Bruix," "Galilée," and "Vaucluse" (construction temporarily suspended) were building; the "Lavoisier" was preparing to build; the "Charner" was completing afoat; and the "Jean-Bart" was being rearmet. At Toulon the "Lazare-Carnot" and "Pascal" were being built; the "Suchet," "Bouvines," and "Jauréguiberry" were being completed afoat, or were at La Seyne awaiting completion; and the "Bayard," "Amiral Duperré," "Courbet," "Trident," and "Redoutable" were undergoing repairs or alterations; while at La Seyne, close at hand, the "D'Entrecasteaux" and "Linois" were building. This is in addition to the work on ships at the private yards at Havre, St. Nazaire, Bordeaux, and elsewhere. ("Le Yacht.")

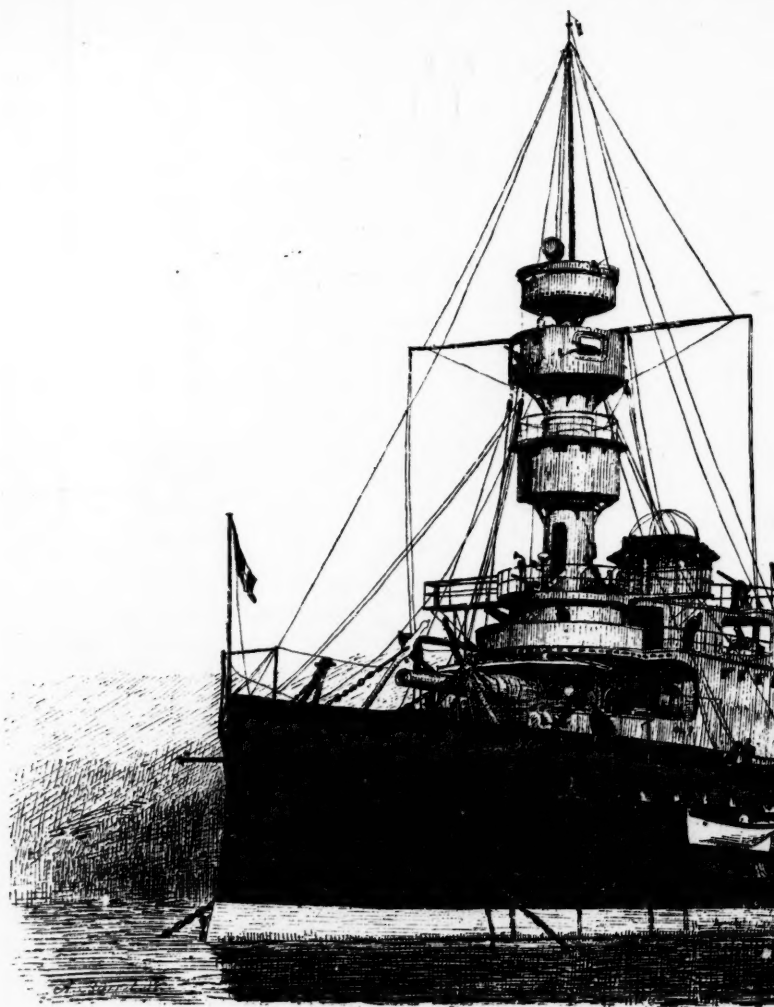
The 1st class armoured cruiser "Chanzy" was launched at Bordeaux on the 24th January, and the 3rd class cruiser "Linois" was launched at La Seyne on the 31st January. We shall give some details of these vessels in next month's Notes.

The 1st class battle-ship "Magenta" (Plate 13), the latest addition to the active division of the Mediterranean Fleet, was launched in 1890, and is a sister-ship to the "Marceau" and "Neptune," which are both also attached to the same squadron. She is 330 ft. long, with a beam of 65 ft. 7 in., has a displacement of 10,610 tons, and engines of 12,000 I.H.P., giving a speed of 16·5 knots. Protection is afforded by an all round water-line belt of steel armour 18 in. thick and an armoured deck of 3·5 in. steel; above this deck forward are also cofferdams filled with cellulose. The armament consists of 4 34-cm. (13·3-in.) 52-ton guns, mounted singly in barbette turrets, which are protected by 14-in. armour; these turrets are placed one forward, one aft, and one on each side amidships, the two latter being sponsored out; 17 6-in. Q.F. guns in a central battery, 4 6-prs., 12 3-prs., and 8 1·5-prs. Q.F. guns, with 6 torpedo-tubes. The "Magenta" has a coal stowage of 800 tons and a crew of 660 officers and men. ("Le Yacht.")

The proposal to make a ship canal between Bordeaux and Narbonne, that is to say, from the Atlantic to the Mediterranean, has been so frequently discussed of late years that a definite statement as to its dimensions and estimated cost is of considerable interest. These statements have recently been published by M. René Kerviller, an eminent French engineer, who was commissioned by the French Government to report on the project; he says, the canal would be 320 miles in length from sea to sea, and would be from 144 ft. to 215 ft. broad, with a depth of from 28 ft. to 33 ft., so as to admit the passage of the largest ironclads. There are to be sidings of three-quarters of a mile long, at intervals of every 8 miles, so as to facilitate navigation and avoid delay of traffic, while there are to be 22 locks, each of which is to be about 650 ft. long by 80 ft. broad, and with a fall of from 20 ft. to 60 ft. The ships using the canal are to be towed or to be drawn along by fixed engines, and M. René Kerviller estimates that a canal of this kind would cost 27,400,000*l.*, and that the interest on the capital lying dormant while the canal was being made would amount to 3,000,000*l.* more, or 30,400,000*l.* in all, while the receipts at the rate of 1*l.* 13*s.* a ton would be, less the cost of working and repairs, 2,400,000*l.*, representing an interest of 5 per cent. on the capital invested.

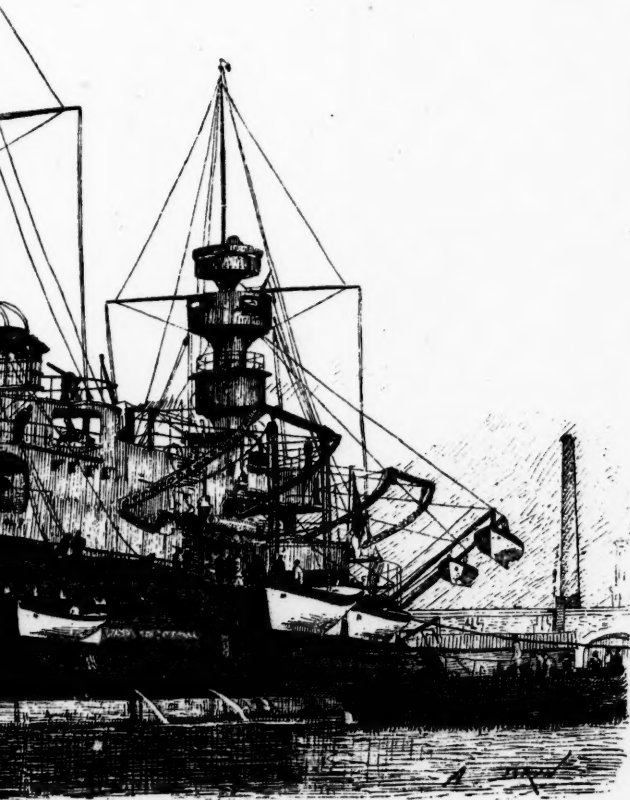
Germany.—Vice-Admiral Schroeder has been relieved from the command of the Manœuvre Squadron and placed *en disponibilité*, and the following further changes made:—Vice-Admiral Koester from Director of the Marine Department in the Ministry of War appointed to the command of the Manœuvre Squadron; Rear-Admiral Karcher from command of 2nd Division of Manœuvre Squadron to the Ministry of War as Director of the Marine Department; Rear-Admiral von Diederichs from Superintendent of the Dockyard at Kiel to command of 2nd Division of Manœuvre Squadron; Captain Diederichsen from Chief of the Staff of Manœuvre Squadron to Superinten-





THE LATEST ADDITION TO THE FRENCH M
THE NEW FIRST CLASS BATTLE-SHIP "MAGENTA"

REPRODUCED BY PERMISSION FROM "LE YACHT."



FRENCH MEDITERRANEAN FLEET,
"MAGENTA," 10,500 TONS, 12,000 I.H.P.

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dent of the Dockyard at Kiel; Captain Fischel from command of battle-ship "Wurtemberg" to be Chief of the Staff of Manœuvre Squadron; Captain Freiherr von Maltzahn from Chief of the Staff at Wilhelmshaven to command of "Wurtemberg"; Captain Bendemann to command of the battle-ship "Brandenburg"; and Rear-Admirals Mensing and von Pawelsz placed *en disponibilité* with the rank of Vice-Admiral. ("Marine-Verordnungs-Blatt.")

The Naval Budget for 1894-95 provides for the increase of the personnel of the Imperial navy by the following:—38 executive officers and 27 midshipmen or cadets, 5 engineer officers, 314 seamen, 72 artificers, 92 torpedo-gunners, 13 surgeons, 12 recruiting agents, and 336 stokers, workmen, &c., besides 117 other persons, or a total of 1,036.

A disastrous explosion, which has resulted in the death of the chief engineer, 5 other engineer officers, and 38 men, occurred on board the new battle-ship "Brandenburg," when on a steam trial off Kiel on the 16th of February. The accident was apparently due to some flaw, either in the safety-valve, or in the main steam pipe of the starboard engines, which burst soon after the ship left the anchorage, about 11 A.M., with the terrible results recorded above to the unfortunate officers and men, with which the stokehold and engine-room were full at the time, and who were for the most part literally boiled alive by the scalding steam. At the time of the explosion the engines were only developing 7,500 I.H.P., while at previous trials as much as 10,000 H.P. had been indicated. The "Brandenburg" is a vessel of 10,300 tons displacement, with engines indicating 10,000 H.P. under forced draught. She is protected by a 16-in. water-line belt of compound armour, tapering to 12-in. at the bow and stern, and she carries for her heavy armament six 28-cm. (11.2-in.) guns in three turrets, which are protected with 12-in. armour.

Three torpedo-boats of the new type, "S 71," "S 72," "S 73," have arrived at Wilhelmshaven from the Schichau works at Elbing, having successfully gone through their acceptance trials before the Naval Commission. Excellent as has been the work hitherto turned out by the Schichau firm, it will be even better in the future, as various improvements, both in the construction of the boats and in the method of launching the torpedoes, have been lately carried out, and we may fairly claim that for efficiency our torpedo-flotilla has reached a point not excelled by any navy in the world. The new boats do not differ materially from the older ones. They have a displacement of 110 tons, with engines of 1,500 I.H.P., which have given them a speed of 24.2 knots. Two new division boats are also building at Elbing, "D 9" and "D 10," which are to be 380 tons displacement, with engines of 4,000 I.H.P., giving a speed of 27 knots; they will be armed with six 6-pr. Q.F. guns, and are to be ready in the course of the summer. ("Kreuz-Zeitung.")

Russia.—The total credit allotted to the Ministry of Marine for the year 1894 is 52,492,803 roubles, or about five and a half millions of pounds sterling. This appears to be some two millions more than the total credit of the last two years. The principal items which refer to naval construction proper are as follows:—Hulls of ships, 10,037,160 roubles; machinery, 2,870,675 roubles; armour, 3,170,532 roubles; total, 16,078,367 roubles. To this must be added 2,605,416 roubles for guns, the largest of which are to be 12 in., thus making altogether 18,689,383 roubles. This sum is to be devoted to the following new ships and torpedo-boats under construction, and to be laid down during the year:—The "Sissoi," 8,800 tons; "Poltava," 10,960 tons; "Sebastopol," 10,000 tons; "Petropavlovski," 10,960 tons; "Admiral Senjavine," 4,126 tons; "Admiral Oushakoff," launched last autumn, 4,126 tons, and the "Russia," a large cruiser of the "Rurik" type, which was laid down at the end of last year, 12,195 tons. All these ships are at present being built or completed at the Admiralty, Baltic, and other yards on the Neva at St. Petersburg. The new ships to be laid down are:—One of the type of the "Sissoi," 8,800 tons; another of the type of the "Rurik," 12,500 tons or larger, which will be the third of this class of large armour-belted cruisers, and a

transport-ship of about 1,200 tons. The smaller vessels to be built are two mining or torpedo-cruisers of the "Vssadnick" and "Gaidamack" types, and eight torpedo-boats, two like the "Anacria," and six like the "Pernov." This completes the list of new vessels for the Baltic.

The six large ironclads of the Black Sea Fleet are to be increased by one of the "Sissoi" type, and another of the class of the "Tri Sviatitelya," 8,800 and 12,480 tons respectively. The new Imperial yacht, the "Standard," 5,557 tons, now building at Copenhagen, is also intended for the Black Sea. The following items are also interesting:—There were spent on the military port of Libau, from 1890 to 1894, 11,660,000 roubles; to be spent during ensuing year, 2,398,000 roubles. For the port of Vladivostock there were spent during same period, 1,600,000 roubles; to be spent in 1894, 800,000 roubles. For rifles for the Navy and for smokeless powder up to 1894, 1,247,000 roubles; for 1894, 700,000 roubles.

A new dry dock has been commenced at Cronstadt, with the view to construct even larger cruisers than the "Russia." The length of the dock at bottom will be 550 ft.; at the top, 625 ft.; the top breadth will be 90 ft., and the depth 30 ft. The sluice gates are being built at Cronstadt, the pumping machinery partly there and partly abroad.

According to the "Novoje Vremja," the Baltic torpedo flotilla is to be increased by over 30 torpedo-boats, to be built at Tschorsk and Cronstadt. At the former place two are already under construction—the "Nargen" and "Gogland"—and eight others of the same type are ordered to be laid down. Others will be built in private yards. Their displacement will be about 150 tons, with a speed of between 26 and 27 knots, hitherto attained only by the Black Sea "Adler."

On the 7th February, from the yard of Messrs. Hawthorn, Leslie, and Co., at Hebburn-on-Tyne, was launched the "St. Petersburg," the third vessel of the class built for the Russian Volunteer fleet, the two former being the "Orel" and "Saratov." The St. "Petersburg" is a twin-screw, three-masted vessel, 460 ft. in length, 54 ft. beam, and 35 ft. deep. Her capacity exceeds 6,000 tons. Her sea speed without forced draught is 19 knots, and ordinary coal stowage 1,200 tons. This, however, can be increased to 4,000 tons, if the vessel is employed as a cruiser. The engine and boiler rooms are in separate compartments, and the ship is subdivided by numerous watertight bulkheads. The pumping arrangements are of great power, being capable of discharging water at the rate of 1,000 tons per hour. The upper-deck is flush and strengthened in order to carry when necessary a powerful armament, which will consist of 10 4.7 Q.F. guns and 19 smaller Q.F. guns. She is 5,500 nominal tons displacement and the engines are to develop 10,000 I.H.P.

As previously announced, the belted cruiser "Admiral Nachimov" and protected cruiser "Rynda" have left the fleet under the command of Rear-Admiral Avelan and proceeded to China.

Admiral Bouratchek, commanding at Sveaborg, and Captain Louschkoff, commander of the gunboat "Tutecha," which sailed in company with the ill-fated "Roosalka," have been tried by court-martial and found guilty of acts of negligence that contributed to bring about the disaster. The Admiral was found guilty of a grave error in judgment in permitting the two vessels to put to sea in the bad weather prevailing at the time, and has been reprimanded by the court; while Captain Louschkoff, for steaming ahead instead of remaining by his consort, has been deprived of all further command of vessels of war. Captain Zarine also, who commanded the cruiser "Vitiaz" when she was lost last summer off the Korean coast, has been deprived of his commission and reduced to the ranks.

A Reuter's telegram states that the two cruisers of the improved "Rurik" type have been commenced, but no authentic details as to their dimensions, &c., are as yet forthcoming. It may be of interest if we give some details of the "Rurik" herself, as her name has been brought forward somewhat prominently of late, and

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it is understood that the "Powerful" and "Terrible" have been designed to beat her. She is 435 ft. long, with a beam of 67 ft., and a displacement of 10,923 tons. Her engines are to develop 13,250 H.P., and to give a sea speed of 18 knots under natural draught. Her estimated speed under forced draught is not given, so that her approaching steam trials will be awaited with interest. She has a coal stowage of 2,000 tons, calculated to take her at economical speed from Cronstadt to Vladivostok without the necessity of replenishing her bunkers. For five-sixths of her length the "Rurik" has a 10-in. steel belt, tapering to 3 in. at the bow and stern; this belt extends from 3 ft. above the water-line to 4 ft. below. There are in addition a 2½-in. curved protective deck, and fore and aft 9-in. armoured transverse bulkheads. Her armament consists of four 8-in. guns in armoured turrets sponsoned out, 166-in. Q.F. guns, also in armoured sponsons, two of which will fire right-ahead and right-astern, six 4.7 Q.F. and 18 6-pr., 3-pr., and 18-pr. Q.F. guns, and five torpedo-tubes for 18-in. torpedoes. As neither the "Powerful" nor "Terrible" are to have any armour water-line belt, and as their heavy armament is to consist of two 9.2-in. guns, as against the four 8-in. guns of the "Rurik," while there will not be any great difference in the secondary batteries of the respective vessels, it is very difficult to see, except in prospective speed, where the superiority of our two new cruisers over the "Rurik" is supposed to lie. Most people will consider the "Rurik," with her 7-ft. deep 10-in. steel water-line belt and her 3-in. protective armour deck, as much better protected than the "Powerful" and her sister with no belt and only a 4-in. protective deck. We believe the armoured deck originated with our Constructor's Department, and was intended to do away with the necessity of side-armour in cruisers. It has since been universally adopted, and has become the fetish of our constructors, so that, as we see, for some years they were so infatuated with the idea, that armoured decks displaced belt armour over a large portion of the water-lines of many of our battle-ships. It is to be noted, however, that of late abroad a reaction has set in against trusting entirely to the armoured decks for cruisers, and we consequently see French, Russian, American, even Spanish, cruisers now being built protected with armour-belts in addition to the armoured decks; our constructors, however, hold to their fetish. We only hope we shall not have to rue it when war comes.

Sweden.—In the Budget for 1895, presented to the Diet by the Finance Minister, provision is made for the increase of the navy, which is now composed of some 60 vessels, most of them, however, of old and obsolete types. It is proposed to build 3 armoured turret ships similar to the "Thule," launched last year, 1 despatch boat, 10 1st class torpedo-boats, 6 2nd class, and a store ship. For this purpose the Finance Minister requires 10,622,000 kroner, to be spread over a period of five years, and of which 2,500,000 kroner is to be included in the Estimates for 1895, amounting altogether to 9,781,260 kroner.

United States.—Some interesting armour-plate trials were carried out in December last at Indian Head; the plates tested were for the side armour of the new armoured cruiser "Maine."

Before this trial took place the advantages of the Harvey process had been made plain by firing at comparatively small plates of uniform thickness, yet it remained a question whether difficulties would not arise when the process should be applied to the various shapes required in actual armour. It was a matter of doubt whether the process of hardening would not so warp the plate that it could not be applied to the ship; or whether variations in thickness and form might not make it difficult to secure armour of uniform character.

The plate tested was 13 ft. 7 in. long, 7 ft. wide, and 12 in. thick for one-half its width, the other half tapering to 6 in. It represented a lot of 475 tons of armour. Two 8-in. armour-piercing projectiles were first fired, of which the first had one-half more energy than was necessary to pierce the same thickness of wrought iron, while the second had twice the energy required for that purpose. The result of the firing was that both projectiles were smashed to fragments against the plate, their points only having penetrated 4 or 5 in., and having been there

firmly welded. In other respects the plate was wholly without injury. The velocity of the second projectiles was 2,004 ft. a second, and the energy 6,968 tons.

To further test the endurance of the plate two more 8-in. projectiles were fired at it, both with a velocity of over 2,000 ft. a second, the second being made to strike the plate near one corner at an angle of 35° , so as to see if such a blow would not crack it, but the result was no crack and less injury than had been received from the previous projectiles.

A 10-in. projectile was now fired at an angle of 35° , and with an energy of 13,564 tons; the plate was cracked but the projectile was broken into fragments like the others. Finally, another 10-in. projectile with an energy of 9,806 ft.-tons was fired at a point $2\frac{1}{2}$ ft. from any of the previous shots, and while the only cracks developed were three very fine ones, the shell, like all the others, was smashed to pieces. The trial was considered most satisfactory, as the plate would still have given complete protection to the ship, and might have been struck several times more before it failed. ("Scientific American.")

Captain Sampson, Chief of the Naval Bureau of Ordnance, has received the report of the board appointed to conduct the trials of the Howell torpedo, at the Newport torpedo station. The report is elaborate, and gives the result of the trials in detail. The torpedoes were subjected to test under the full requirements of the contract. After a careful inspection they were tried from a stationary platform and then from a vessel under weigh.

The torpedoes were required to run 400 yards and maintain a speed of 22.5 knots during that distance. The results of the tests were very satisfactory. Twenty-five knots was the maximum speed developed, while the minimum speed was 22 knots. Of the 88 runs made there were but three which could be classed as mis-haps—one being a miss-fire and the other two dives to the bottom. The report states that the regulating mechanism worked well, and the contract requirements as regard accuracy were fulfilled.

The torpedo-boat "Stiletto" did not exceed a speed of 15 knots during the trial. This, the board reports, was due to two reasons:—First, the extent of the basin was too limited to permit attaining full speed without a turn shortly before launching, during which the effect of the rudder slowed the boat materially; secondly, the demands of the motor on the steam supply operated to slow the engines. This last reason was not so apparent exhausting into the atmosphere as in exhausting into the condenser. The added efficiency of the draught when exhausting into the smoke pipe probably made up for the increased demand on the steam supply. The report states that in order to maintain the speed of the boat while the torpedoes are being spun up it will be necessary to increase the capacity of both boiler and condenser above that of normal requirements. Atmospheric exhaust obviously cannot be used on account of noise and the formation of vapour clouds, which would show plainly in the beams of a search-light.

The board report that the present motor used by the contractors gives the required speed to the wheel in from 2 to 2.5 minutes, with 130 pounds effective steam pressure. It has not, however, sufficient power to fulfil the contract requirement as to time of spinning up with any available steam pressure. The motor cannot be heard under conditions favourable to the transmission of sound even under a distance of 400 yards. ("Army and Navy Journal.")

The Howell torpedo, the invention of Captain Howell, U.S.N., is very simple and may be termed the gyroscopic torpedo. It depends for its motive power upon the momentum of a heavy fly-wheel. This torpedo is a small cigar-shaped vessel, worked by double propellers, no engine or motor other than a fly-wheel being required. The torpedo may be set to run either on the surface or under the water, and, owing to the gyroscopic character of its motive power, it will automatically maintain with great exactness the line of travel on which it is set. Prior to discharging the torpedo its fly-wheel is set in motion at a high velocity. The fly-wheel of an 8-ft. torpedo is capable of storing up a power of 347,000 ft. pounds and driving the torpedo half-a-mile or more with great speed.

Another torpedo, the Cunningham, has lately been tried before a board of officers at Newport. Like the other, it is cigar-shaped and carries the explosive charge at its head. It is intended to travel either submerged or on the surface of the water.

It has no screw or propeller but has extending from the explosive chamber to the stern eight ribs or spirals, with a twist of one turn in 48 ft. These give the torpedo a rotatory motion similar to that imparted to a rifled bullet. All the portion of the torpedo aft of the chamber for the explosive is filled with a rocket composition tightly pressed in. The gases escape forward through a large number of small holes, just aft of the explosive chamber and aft through a smaller number of larger holes in the stern. It is the escape of this gas which forces the torpedo through the water. The torpedo tried was 17 ft. long and 15 in. in diameter. Electricity exploded the composition. The firing tube was run out, so that the torpedo was 4 ft. below the surface when fired. ("Scientific American.")

The protected cruiser "Detroit," which completed her trials in the latter part of last year and has since been commissioned, is a vessel of 2,050 tons displacement, is 257 ft. long, has a beam of 37 ft. and engines of 5,400 I.H.P. For her size her armament is a formidable one, consisting of two 6-in. guns, mounted respectively above the poop and forecastle, and protected by 2-in. steel shields; eight 5 in. Q.F. guns in sponsons on the broadside, six 6-prs., two 1-prs., two Gatling guns, and five torpedo-tubes. At her trial the engines developed 6,000 I.H.P., giving a speed of 18.7 knots, which was 600 H.P., and 0.7 of a knot in excess of contract, the builders thus win a bonus of 150,000 dols. The "Montgomery," a sister ship, has also completed her trials and averaged 18.8 knots over the course; after the tidal correction was made, the speed was found to be 19 knots, so that in her case the contractor will receive a bonus of 200,000 dols. in addition to the contract price. The trial was conducted with a steam pressure of 166 lbs., and the average number of revolutions was 180. ("Scientific American.")

MILITARY.

Austria-Hungary.—The Hungarian Ministry of Defence has issued new regulations for the Honved Cavalry. In war time each regiment has to supply one pioneer troop and a mounted telegraph patrol—each "Ersatz" dépôt, one "Ersatz" squadron, and a group of dépôts, one troop of staff orderlies. The "Ersatz" squadron keeps the field squadrons and regimental staff supplied with men and horses, and is responsible for the training of recruits, breaking and training of horses, &c. To superintend all these functions, inspectors of Honved Cavalry and "Ersatz" dépôts are to be appointed, and will be placed under the district commander.

The peace strength of a Honved hussar regiment, inclusive of staff and dépôt, is 39 officers, 417 men, 331 horses, which expands on mobilization, to 56 officers, 1,482 men, and 1,471 horses, of whom 1,236 are mounted combatants. Deducting special details, the total strength of the 10 hussar Honved regiments may be taken at 15,000 combatants.

Experiments with celluloid cartridge cases—the idea being that the cartridge is consumed in the chamber, thus doing away with the necessity for an extractor—have hardly been satisfactory; they keep badly, are easily broken, and the combustion is not complete. ("Preuss. Jahrbücher," March.)

Belgium.—Military governors for the "positions" of Liège and Namur have been appointed. With reference to the two fortresses which form the kernel of these positions, the "Militär-Wochenblatt" gives the following information:—Liège is protected by three large and three small forts on either side of the river. Namur has three large and three small forts on the left, one large and two small

works on the right bank. Each work of the same class will have the same armament. In the large forts there will be two turrets for one 21-cm. howitzer each; one turret for two 15-cm. guns; two turrets for two 12-cm. guns each; and four eclipse shields for Nordenfölt Q.F.'s (5.7-cm.). The small forts will mount one 21-cm. howitzer turret, one turret for two 15-cm. guns, two for one 12-cm. gun each, and three to four eclipse shields for Q.F.'s, which gives a total of 212 guns protected by armour. Date of completion not stated.

Denmark.—The following progress in the defences of Copenhagen is noted by the "*Militär-Wochenblatt*":—The north and north-west fronts of the land defences and the gorge of fort "Fortun" have been provided with stone revetments. The engineer works at the "Bagsvaerd" fort finished, and the "Gladaxe" fort completed, in or near these works. There are now nine telescopic observatories in the west enceinte; two magazines have been constructed out of concrete for the installation of dynamos for the electric projectors. An armoured train of six trucks, each mounting one short 15-cm. gun, will run on rails laid parallel to the enceinte throughout its length. On the enceinte itself there are 14 permanent observatories with telescopes. The earthwork at the "Middelgrund" fort is nearly complete, 14 per cent. only remaining to be done; and the concrete work on the casemates is finished. Fort "Provestenen," forming part of the old work, has been strengthened on the sea front by the addition of 37 ft. of concrete to cover the old masonry.

France.—*The Atlantic-Mediterranean Canal.*—The "Canal des Deux Mers" Company, Limited, have resubmitted their plans to the Chambers since their opportunity for their discussion was afforded last session. The scheme is the work of M. René Kerviller, and provides for the formation of a canal 26 ft. 6 in. deep, capable of being dredged out to 32 ft. 6 in. Twenty locks, or groups of locks, are designed, and the alignment runs from Bordeaux, with a branch to Arcachon by the right bank of the Garonne to Toulouse, where it crosses the river to Narbonne, and thence by the Lagoon of Gruissan into the Mediterranean. The estimated cost is 30,000,000*l.*, and the company has started a paper of its own to discuss its project in all its bearings and attract capital. It is put forward as the French reply to the German North Sea Canal, and, therefore, a patriotic work; but the naval officers who have discussed the question in last month's publications do not seem inclined to take the matter seriously, much to the disappointment of the promoters.

The proposal to transfer the pontoon equipment from the artillery to the engineers, recently put forward by the War Minister, is attracting considerable attention in the services concerned. For the change it is urged that all other European Powers have long since adopted the system; against it, that the existing plan works well, and any alteration would disorganize both services for a term of years. The "*Avenir*" says tradition, and especially the tradition of the Berezina, is strongly against the change; in face of Marbot's revelations as to the fordability of that stream the reference appears to us unsatisfactory—at least, inconclusive.

With reference to the manœuvring of the monster armies of the day, a series of articles in "*L'Avenir Militaire*," headed "*L'Armée Actuelle*," deserves attention. Briefly, the author urges that, as with the increment of effectives in the early years of the revolutionary wars the strategic unit grew from the division to the corps, so now the time has come to carry the idea of the corps upward into the army, and permanent army staffs should be created. The articles are worth study.

"*La Réforme Économique*" under the heading "*A National Danger*," calls attention to the deficiency in rolling stock on the French railways. In 1891 the German Government ordered 504 locomotives and 3,500 carriages to be delivered within the

year. This gave her a total of 14,000 loco's. The French replied, in 1892, by ordering 250 loco's. Germany immediately placed contracts for 300 more. This gave Germany 35 loco's per 100 kilometres of line open against 29 in France. These facts being submitted to the French Government, 2,940 carriages were put in hand. Since then, besides large sums for rolling stock and maintenance, Germany has added 325 loco's, the net result being an increment of 10 per cent. in her capacity for dealing with troop traffic. A fresh inquiry has been instituted in France, and it is officially stated that to bring her railways up to the German standard 6,000 loco's, 9,000 carriages, and 80,000 trucks are required.

Germany.—The fortress manœuvres at Thorn promise to be of unusual interest, as the Emperor is expected to direct in person. In the main outlines they will be similar to those of last year, and will take place on the left bank of the Vistula. The 1st, 2nd, 5th, 11th, and 15th Foot Artillery regiments, together with the whole garrison of the place and detachments of the 2nd Corps from Bromberg, Guesen, and Inowrazlaw will be concentrated for the purpose. A great feature will be experiments under strictly service conditions with the Maxim gun.

By a recent German Army order the rules for admission to the "Kriegs-akademie," or German Staff College, have undergone an important modification which will entail officers joining that establishment at an earlier age. Previous to 1888 officers were only required to have three years' service before joining the "Kriegs-akademie," and, on the other hand, were not allowed to go there if within four years of their probable promotion to the rank of captain.

In 1888, however, the rules were modified to the extent that officers were required to have five years' service instead of three, the other conditions remaining the same.

By the order of 8th December, 1893, it is laid down (as was the case prior to 1888) that only three years' service is compulsory before joining, but, on the other hand, officers will not be allowed to compete if within five years (as against four as heretofore) of their probable promotion to captain's rank.

The "Kreuz Zeitung," 10th February, devotes a long leader to the proposed reform in Prussian court-martial procedure submitted to the Reichstag by Rickert and his Social Democratic following, the purport of which, briefly, is to adopt the idea of an "open court" precisely as it obtains in England. Needless to say, the "Kreuz" sees in the acceptance of this proposal the ruin of Prussian discipline, and those interested in the matter will find some exceedingly suggestive lines of thought by consulting the original.

Long Distance Rides.—Two good performances are recorded in this month's papers. Lieutenant Zimmermann, 16th Uhlans, from Salzwedel to Magdeburg and back, 117 miles in 24 hours, inclusive of 3½ hours' rest, bringing his horse in in good condition in spite of snow and slippery roads. Over a more trying course, and under worse conditions of weather, Lieutenant Frieherr von Fürstenberg, Guard Cuirassiers, covered 105 miles in 17½ hours, of which only 1½ were devoted to rest. The horse was reported none the worse. The darkness of the night must be taken into account in judging these performances.

The "Kreuz Zeitung," 20th February, states that it is hoped to reduce the weight carried by the infantry soldier by about 14 lbs. The number of rounds carried will be only 120, against 150, the present scale. The number of entrenching tools per company will also be diminished, and a reduction made in the weight of the iron rations carried, besides the substitution of aluminium for water bottles, &c., already referred to. The exact details are not yet forthcoming, but the above indicates very closely the conception of tactics and strategy current in the Prussian General Staff.

In the debate on the army estimates, 13th February, in the Reichstag, the important announcement was made that for the future Polish recruits would no longer be drafted to regiments in German provinces, but will serve in their own districts.

Suicide in the German Army.—About 18 months ago attention was drawn by the Socialistic press to the prevalence of bullying by the non-commissioned officers in the German army. The same press further alleged that the rate of suicide in the army was out of all proportion to that of the civilian population, their purpose being obviously to connect the two. The "*Reichsanzeiger*" promptly contradicted this statement, which contradiction was, of course, comfortably ignored by the offending papers, as is the custom of such people all the world over. An investigation of the matter was, however, set on foot, and the result is an article in the Supplement to the "*Militär-Wochenblatt*" of very great interest. Statisticians have long been aware that the Germanic race is more addicted to suicide than any other European race, but Germany does not head the list in the armies; on the contrary, Austria, with its mixed contingent of semi-Oriental races, almost doubles the German rate. The English rate, though numerically less, is proportionately greater, but India amply accounts for this.

Suicide is always relatively more common amongst soldiers than amongst civilians, and the reasons why it should be so are tolerably self-evident. Men of the same social rank, as the majority of the soldiers are in civil life, almost without sense of shame and dishonour, and should they feel either acutely, they can change their surroundings; as a rule, also, death is far more terrible to the man who has not been trained by his surroundings to face it. How weak the position of the Social Democrats is, is abundantly shown by the fact that the majority of cases were supplied by the non-commissioned officers themselves, whom no one can suppose to have been bullied. Finally the paper notes that since 1880 the rate has been constantly falling, and is now only 75 per cent. of what it was then. The whole article is worthy of the closest study.

Roumania.—On the 1st January, 1894, 60,000 stand of repeating rifles, 6.5-mm. calibre, had been delivered by the "Steyr" S. A. Company; the remaining 51,000 are due in May. Orders for a similar carbine have been placed.

Russia.—The "*Kreuz Zeitung*," Berlin, 6th March, is responsible for the statement that the condition of the Russian rolling stock is most unsatisfactory; want of locomotive power the chief difficulty. To remedy this, large contracts have been placed in Austria, and smaller ones in Germany.

The French interrupted screw breech-piece will be introduced in all future guns delivered to the horse artillery. This change has already been effected in the light field guns. ("*Preuss. Jahrbücher*.")

A new disappearing carriage for siege and fortress guns, to fire over 7 ft. bank, the invention of Lieutenant-Colonel Razskazow, has been introduced for the 15.3-cm., 10.5-cm., and 24-pr. bronze guns. The gun is worked by the recoil. The carriage, with wheels, weighs 36 cwt., and allows of 26° elevation and 2° depression. ("*Preuss. Jahrbücher*," March.)

Attention is called to the nominal roll of officers holding command in the Russian service, published in the "*Revue Militaire de l'Étranger*," too long for republication here.

Switzerland.—The proposed reorganization of the Federal Army will raise the number of batteries from 43 to 56 field artillery—and gives nine mountain batteries of 4 guns each in place of the existing two batteries of 6 guns; the fortresses' batteries will be increased from 10 to 15—which together make a total increment of 48 field guns, 24 mountain guns, and 40 siege guns.

Taking the field army at 104 battalions 800 strong, this give 4.5 guns per 1,000 men, or reinforcing the field army with a reserve brigade of infantry to each corps, —3.6 guns per 1,000—for comparison we add the proportions obtaining in other armies.

In Germany, for field army, 3.8 per 1,000, reinforced by reserve formations 3.0 per 1,000. In France, 4.3 to 3.6. Italy, 3.6 to 3.0. Austria, 3.6 to 3.2.

Autumn manœuvres will take place in the district of the 4th Corps in the vicinity of Schwyz Uznach, commencing on the 6th September and concluding on the 14th same month.

According to the *„Allgemein Schweizer Militar Zeitung,”* Hebler now admits that the tubular *lead* bullets are a failure, as they leave the muzzle too misshapen for accurate flight. He is all the more confident in the future of the steel tubular bullet: but the low specific gravity of the metal is heavily against him. (*„Preuss. Jahrbücher,”* March.)

FOREIGN PERIODICALS.

NAVAL.

Le Yacht.—Paris. January 6th, 1894. “War Navies in 1893” (E. Weyl). “The Decree of the 20th November, 1893, relative to the Lights of Boats, &c., on Rivers, Canals, &c.” “On the Employment of ‘Cartouches Solubles’ Oceanographical Researches.” 13th January, 1894. “War Navies in 1893” (*conclusion*). “The Dockyards and state of Ships under construction on 1st January, 1894.” “Our Merchant Navy in 1893.” 20th January, 1894. “Criticisms on the Fleet” (E. Weyl). “The Explosion on Board the Torpedo-boat ‘Sarrasin.’” “On the Shape and Position of Rudder for Manœuvring Steamers.” “Foreign Navies.” 27th January, 1894. “The Enquiry on the Navy” (E. Weyl). “Subsidies to Steamship Companies.” “Launch of the Cruisers ‘Chanzy’ and ‘Linois.’” 3rd February, 1894. “The Enquiry on the Navy” (*continued*). “Annual Session of the Maritime Technical Association.” “The Torpilleur-de-haute-mer ‘Lansquenet.’” 10th February, 1894. “The Interpellation in the Chamber on the Navy.” “The Maritime Technical Association” (*continued*). “Merchant Navies—France and England.” 17th February, 1894. “The new Regulations relative to the ‘Cadres’ of Officers of the Navy.” “The Maritime Technical Association” (*continued*). “The Niger Flotilla.” 24th February, 1894. “New English and French Battleships” (E. Weyl). “The Maritime Technical Association” (*continued*). “The Explosion on Board the German Battleship ‘Brandenburg.’”

La Marine de France.—Paris. 6th January, 1894. “Our Navy. Is it Ready?” “Paris as a Seaport and Inland Navigation.” “The Mediterranean and Atlantic Canal.” “Naval Notes.” 13th January, 1894. “Electricity and Coast Defence” (Rear-Admiral Réveillère). “The Mediterranean and Atlantic Canal” (*continued*). “The Progress of Ideas.” “Naval Notes.” 20th January, 1894. “A propos of Exercises in Strategy.” “Paris as a Seaport” (*continued*). “Naval Notes.” 27th January, 1894. “Rappel aux Principes (Coast Defence).” “Large Steam Yachts.” “Naval Notes.” 3rd February, 1894. “The Young School and Commandant Vallier” (Rear-Admiral Réveillère). “Some Notes on the Italian Navy.” “Naval Notes.” 10th February, 1894. “A Grave Blunder.” “Quiberon” (Rear-Admiral Réveillère). “Large Steam Yachts.” “Naval Notes.” 17th February, 1894. “Submarine Navigation.” “The ‘Magenta.’” “Naval Notes.”

24th February, 1894. "The Defence of Corsica." "An Aluminium Yacht." "Electricity as a Motive Power" (Paul Fontin). "Naval Notes."

Marine Rundschau.—Berlin. January, 1894. "The History of S.M.S. 'Mercur'." "Naval Health Regulations." "Reports from Ships on Foreign Stations." "Naval Notes—Home and Foreign." "Promotions, Appointments, &c." February, 1894. "The History of S.M.S. 'Mercur'" (*concluded*). "The Hygienic Condition of Santa Cruz de Teneriffe." "Remarks on the Deviation of the Compasses on Board S.M.S. 'Buzzard.'" "Reports from Ships on Foreign Stations." "Naval Notes (Foreign)." "French Armour-plate Trials." "Promotions, Appointments, &c."

Mittheilungen aus dem Gebiete des Seewesens.—Vienna and Pola. January. Vol. xxii. No. 1. "Competitive Trial of Armour-plates at Pola." "The Three Latest North Pole Expeditions." "The American Submarine Torpedo-boat." "The Organization of the French Semaphore Service." "Naval Notes (Foreign)." No. 2. "Subsidies to Merchant Navies." "The Manchester Ship Canal." "A New Instrument for Measuring Distances." "Naval Notes (Foreign)." No. 3. "Biserta." "The Double Altitude Problem." "Diagrams for Determining the Radius of Action at Sea." "Naval Notes (Foreign)." "The New Admiralty Buildings at St. Petersburg."

MILITARY.

Revue Militaire de l'Étranger.—No. 795. February. "The Manœuvres of 1893 in the District of Warsaw," with General Gourko's "critiques"; well worth study. "Augmentation and Reorganization of the Field Artillery in the Austro-Hungarian Army." "Umpires at the Great Manœuvres in Hungary." "The Swedish War Budget."

Spectateur Militaire.—15th February, 1894. "Consolidation of Pensions" (by Noël Desmayons). "Marshal Fabert" (by L. Samion). "Les Mousquetaires de la Maison du Roi" (by Boissonet). "Timbuctoo—Defence of Coasts." "The Atlantic-Mediterranean Canal." 1st March. "Strategy in relation to the Art of War" (by Desmayons). "Flank Movements" (by Samion). "Campaign in the Pyrenees, 1813-14" (by Boissonet). "Our Railways in War."

Revue de Cavalerie.—February, 1894. "Impressions of Saumur" (by the Marquis de Roccagiovine, a well-known Italian expert in equitation). A very readable article. "Cavalry Manœuvres at Bléré" (*continued*). "Provisional Hussar Regiments under the First Empire." "Selection in the Cavalry." "Cavalry Reinforcements and Remounts for the Grand Army, 1806-7" (*continued*). "The Paces of the Horse, examined experimentally" (by Lenoble du Teil)—(*continued*). With reproductions of M. Marey's instantaneous photos. "Examination Papers for Entrance to the 'École Supérieure de Guerre.'"

Journal des Sciences Militaires.—February. "The Reserve Regiment and the 'Loi des Cadres'" (by Major-General Lewal)—(*concluded*). "Organization of the Engineers." "The Camp at Malmédy."—Criticism of the camp the Germans propose to establish there, and possible object of the move. "La Bataille de Vesles" (by Nigote)—(*concluded*).—The author pleads for the defensive, rejecting the revival of the Napoleonic battle which has found such favour in France since Boulanger. His conclusions are all based on the nature of the weapon, not on the man who carries it. "Proposed Regulations for Infantry." (*concluded*). "The Cavalry of the Allied Armies in 1814" (by Weil). "Victory—Its Conception by the Great Generals" (by Dervieu).

Revue du Cercle Militaire.—No. 5. "Russian Railways." "Recollections of Tonkin." "Feeding of Troops in Time of War." No. 6. "Our Operations in

the Soudan." "The Flying Machine of Professor Wellner," with plates. No. 7. "Amongst the Touaregs of the South." "Electric Projectors." "Recollections of Tonkin." No. 8. "The Railway from the Senegal to the Niger." "Electric Projectors," with sketch.

L'Avenir Militaire.—2nd February. "The French Infantry." Calls attention to the article "À propos des Grandes Manœuvres," November issue of "Nouvelle Revue," agreeing with the criticisms which show the French infantry in anything but the *couleur de rose* light to which press opinions, English and French, have accustomed us. "Observations on the Modifications in the 'Loi des Cadres'" (*continued*). 6th February. "Conflicts between the Civil and Military Authorities in the Soudan." "The Defence of the Alps." "The Load carried by the Soldier." "The Defence of the Coasts." 9th February. "Infantry Tactics." Review of Commandant Nigote's "Bataille de Vesles," and other Studies in the "Journal des Sciences Militaires." "Official Returns in the Navy," calling attention to the conditions of the estimates paid by the spending department. Important. "The Protection of the 'Littoral'" (by General Cosseron de Villenois). "The Surprise at Dongol." "The Fortifications of Paris." "Observations on the Modifications in the 'Loi des Cadres.'" "Reorganization of the 'École Spéciale Militaire.'" 16th February. "The Protection of the 'Littoral'" (*continued*). "The Recruiting of Sub-lieutenants of the Reserve." "La Loi des Cadres" (*continued*). "Letters on the Surprise at Dongol." 20th February. "The Reform of an Abuse." Comment on General Mercer's action in stopping officers drawing travelling allowance when already in possession of free passes. "The Army as it Exists." "La Loi des Cadres" (*continued*). "Decree relative to the Defence of the Coast." "Decree Regulating Reorganization of Gendarmerie." 23rd February. "The Pontonniers." "Comments on proposed Transfer of Pontoon Troops from Artillery to Engineers." "Promotion in the General Staff." "Maritime Operations and Disembarkations." Correspondence: "How to Complete our Field Batteries." Important. "The Army as it Exists." "La Loi des Cadres" (*concluded*).

Mittheilungen über Gegenstände des Artillerie- u. Genie-Wesens.—No. 2, Vienna. "Photo-Electric Projectors" (by Carl Exler, Captain K.K. Engineers). 3 plates. "The Provisional Fortification of Strategic Points" (by Buinizki). Translated from the Russian, 2 plates. "Armour Plate Experiments at Pola." "Artillery Experiments at Elswick." Reviews, &c.

Jahrbücher für die Deutsche Armee und Marine.—No. 270. March. "Frederic the Great's Return to Berlin, 1763." "The Direction and Control of the Manœuvres and Fire of Heavy Artillery in the Attack of Fortified Positions" (by von Speck, Major-General, A.D.).—(*concluded*). "The New Fortifications of Copenhagen" (by Trobenius, Lieutenant-Colonel, A.D.).—(*concluded*). "The Russian War Harbour of Libau: Its Strategic Importance." "The Canadian Snow-shoe for Military Purposes" (Steinitzer, Pr.-Lieut.). "Entrenching Tools and Explosives carried by the French Infantry, and their Employment in the Field" (Graf von Haslingen, Major). "The Evolution of Field Artillery from 1815 to 1892;" Review of Müller's recent work on the subject. "Russian Officers" (by a Russian General). "The Existing Conditions in the Hungarian Landwehr and Landsturm." Reviews, &c.

Militär-Wochenblatt.—No. 11. "Infantry Tactics of To-day," a criticism of von Scherff's latest publication. "The French Army in 1893." "Summary of Changes and Statistical Notes." No. 12. "A few Words about our Infantry at Beaune-la-Rolande" (by Major von Alvensleben). "Comment on Scherff's Work." "Infantry Tactics of To-day" (*concluded*). "Foreign Opinions on High Velocities." "Quick Firers for F.A." (*concluded*). "Comment on General Engelhardt of the Russian Artillery." Interesting for its concluding paragraphs, in which it is stated that the adoption of Q.F.'s in the Russian artillery is now only a matter of time. No. 13. "Retrospect on the Training of Infantry." An interesting and most instructive article. "The New Italian War Minister and his Programme." "Defeat

of the Dervishes by the Italians at Agordat." "The Field Artillery of the United States." No. 14. "Metz defended by Armoured Gun Emplacements." "Review of Captain Meyer's Work." "Correspondence from Austria-Hungary." No. 15. "The Russian Railways." Important. "The Regulations Controlling Fire in the Italian Field Artillery." "Entrance Conditions for the French Staff College, 1894." No. 16. "Distribution of Orders in the Infantry, 'Adjutants and Orderlies.'" "The Battle of Bomu Kaudi on the Congo." "Manœuvres in the French Army, 1894." No. 17. "The War on the Loire. Reply to Lettow Vorbeck" (by Hoenig). Important. "The Combat at Etoges, 14th February, 1814," lecture by Captain von Sothen before the Military Society." "Smokeless Powder." No. 18. "The War on the Loire" (by Hoenig)—(continued). "New Regulations for the Austro-Hungarian Artillery."

Revue Militaire Suisse.—15th February. "Obituary Notice of General Hertzog." "Continuation of Proposed Scheme of Reorganization submitted to the Federal Council." Worthy of attentive study. "The Engineers in the New Organization."

NOTICES OF BOOKS.

The Story of a Cavalry Regiment—the Fourth Iowa Volunteers from Kansas to Georgia, 1861-65. By WILLIAM FORSE SCOTT, late Adjutant. London: G. P. Putnams, 24, Bedford Street, Strand.

"The story of this regiment," says the author, "were it not proven, would appear incredible," and we quite agree with him. It makes a very severe strain on our credulity indeed to find that a regiment of any arm could go through four long years of battle and bloodshed, engaged almost daily against heavy odds and a determined enemy, suffering sickness, hardship, and starvation, and when the total butcher's bill is balanced up it turns out that "the romances of chivalry were surpassed" at a cost of 7.5 men per mille per annum killed in action or died of their wounds, and 22.5 died of disease or accident per mille per annum. Many a British regiment serving in India in those years with never the smell of powder, except in the cemetery, to cheer them, would have been thankful to change death-rates with their American comrades, and all of us will be glad to learn that the reputation of heroism can be won at a total risk of life considerably less than half the risks we have already surmounted in the cradle. The author lacks all sense of proportion. The American War was great enough, in the courage displayed on both sides, the total slaughter entailed, and the sufferings borne by all classes, to call for no exaggeration on the part of its historians. Still less do its incidents justify the use of opprobrious epithets, such as "rebels," to the combatants, or sneers at their courage.

Making due allowance for the writer's imperfections, the book is worthy of careful study by officers of all ranks of the service. Some day, perhaps not so very far in the future, we too may be called on to organize in haste our national fighting power, and the experience gained by our kinsmen across the Atlantic should prove of the utmost service to us. The tact necessary to command undisciplined forces, the faults on both sides to be avoided, the impossibility of improvising efficient mounted services, all these lessons may be derived from its pages. Though frequently compelled to dismount and fight on foot by conditions of the ground, it is very obvious that the intention from the first was to employ the regiment as "cavalry" proper, their armament points to that conclusion, and their record establishes it, and if their charges were not ridden home with the precision displayed by the horsemen of Seydlitz, Le Marchant, and Anglesey, it was not from want of will, or from the greater fire-power against them, but simply because want of training precluded the individual control of the horses necessary to drive them into the enemy's ranks.

The following extract will best show the difficulties which had to be overcome at the start, and if we can hardly suppress a smile at the picture it presents, it will enable us the better to appreciate the zeal and industry of all ranks which ultimately evolved a truly efficient fighting force from such unpromising materials:—

"Fully equipped now for the field, the green cavalryman was a fearful and wonderful object. Mounted upon his charger, in the midst of all the paraphernalia and adornments of war, a moving arsenal and military dépôt, he must have struck surprise, if not terror, into the minds of his enemies. Strapped and strung over his clothes he carried a big sabre and scabbard four feet long, an Austrian rifle or a heavy revolver, a box of cartridges, a box of percussion caps, a tin canteen for water, a haversack containing rations, a tin coffee cup, and such other devices as were recommended to his fancy either as useful or beautiful. . . . His horse carried, on the saddle, a pair of thick leather holsters, a pair of saddle-bags filled with the rider's extra clothing, toilet articles, and small belongings, a nose-bag, perhaps filled with corn, a heavy leather halter, an iron picket pin with long lariat, two horse-shoes with nails, a curry comb and horse brush, a set of gun tools and materials for the care of arms, a rubber blanket or poncho, a pair of woollen blankets, a blouse, a cap or hat, and such other utensils and such other articles of clothing or decorations as the owner was pleased to keep. This mass of furniture would weigh, with the saddle, say, 70 lbs.; so, including kit on the rider and rider himself, the weight on the horse came to from 200 to 250 lbs. Yet some of the men were not content with the regulation load. They added a set of plate armour to it. Among the scores of articles for various uses which were peddled in the camps within the first year of the war was an 'armoured vest.' It was a vest of blue cloth, cut in military style, with two plates of steel formed to fit the body and fastened between the cloth and the lining . . . and some of the horses had, therefore, 8 to 10 lbs. extra to carry."

By degrees the greater part of this gear was shed; the armoured vests went first, and towards the end of the war the wonder ceased to be "how the cavalryman succeeded in getting on his horse or inducing him to move," and became "how a man could live and exist with so meagre an equipment."

It is worth noting that with an average of 1,000 men on the rolls the regiment expended 5,000 horses on marches aggregating 6,500 miles. Compare these figures with the expenditure of horses in individual regiments in the Franco-German War, and the contrast between trained and improvised cavalry becomes very striking. The average from all causes throughout the war was 20 per cent., or, allowing for the different duration of the campaigns, about one quarter the above.

Méthode de Dressage du Cheval de Troupe. Par P. PLINZNER. Écuyer de S. M. L'Empereur d'Allemagne. Paris: Berger Levrault, 1894.

The above is an abbreviated translation of Plinzner's work in German, briefly noticed in last month's Journal. A few notes from an eye-witness of his methods may be interesting:—"Plinzner, as already stated, is responsible for the training of His Imperial Majesty's horses. His chief difficulty consists in securing men with sufficiently light hands not to injure his horses' mouths, a difficulty with which most horse owners are sufficiently acquainted. The men sent to him are selected from the second year batch of the different cavalry regiments; they possess some natural aptitude for horsemanship, but very little more. The first point is to teach them that the reins are not meant to hold on by, a point often overlooked; the second, to convey to them the feel of a properly trained horse under them; and this is always and everywhere the chief difficulty. Place a young horseman on a lively brilliant animal and he falls off, place him on a staid wooden-jointed old crock and though he may remain in the saddle he acquires no correct idea of what a horse should feel like under him.

"A horse only goes well in proper balance, i.e., with his weight distributed over all four limbs and the haunches sufficiently under him. This poise depends on the maintenance of the correct position of the head, and can be obtained either by bending the neck according to the 'Baucherian' method, in which all the vertebrae of the neck take their share, or by the bend from the pole of the neck

as aid down in our own regulations. Plinzner favours the former, and for his purposes no doubt he is right; this bend also favours the use of the essential feature of his system, viz., the auxiliary reins. These are very simple—two short lengths of indiarubber buckled to either rein and made fast to the saddle. The rider's hands are thus set at liberty and the poise of the horse maintained by the even elastic bearing communicated to the bit. The men are then drilled in the ordinary manner, controlling their mounts only by balance and leg, and certainly the results are very striking. I have seen the ride negotiate all the usual riding school obstacles, and though the horse's head is, to my mind, carried too low, I have never heard of one of them bringing his rider to grief, and it must be remembered these horses are ridden to the boar-hounds through woods and over broken ground pretty fearlessly. I am aware of the objections to the method, and am myself strongly opposed in principle to the 'Baucherian' bend, but if it fell to my lot to reorganize a squadron taken over in bad condition, I should unhesitatingly make use of it. Train half a dozen horses into good form and then let all the squadron ride them till they had secured some idea of what a good horse should feel like under them."

— *Studies in Statistics.* By G. B. LONGSTAFF. London: Stanford.

We offer no apology for this belated notice of this important work. One of the great needs of both Services is, and always has been, a sufficient number of officers trained to observe and appreciate facts in the order of their relative importance, and the study of this work will familiarize its readers with the only reliable method by which the true bearing and influence of events and causes can be arrived at. Figures giving losses in battle, deaths from exposure on the line of march, from epidemic sicknesses in cantonments, form the foundation of all tactical and administrative reform, but in the hands of men unaccustomed to their consideration they are the veriest will-o'-the-wisps the mind of man can pursue. A case in point may make this clearer. The conventional view of the influence of modern weapons on warfare founded on the total losses—not the percentage of loss—is that such a degree of perfection has been attained that annihilation must be the fate of any body of troops taking the field. Statistics show, on the contrary, that the effect of improvements in weapons has been so far discounted by other changes in organization that war has steadily become less bloody in each successive generation. On this false generalization from incompletely appreciated facts the wildest changes in tactical methods have been and are constantly being put forward, which, if carried into effect, must entail defeat, and, consequently, increased slaughter to the troops employing them, i.e., increase the evil they are designed to alleviate. In the every-day questions of army organization that arise the same methods lead to the obstruction of useful reforms initiated by the authorities, who alone command the requisite statistical information, at the hands of well-meaning gentlemen who have never been trained to handle their subject. The death-rate of young soldiers in India is an example. If a young officer wishes to do useful work for the Service, he can only achieve his purpose by mastering the art of accurate thinking, and for this purpose books on the lines of the one now under consideration will be found invaluable.

— *Discipline: its Reason and its Battle Value.* By Lieutenant STEWART MURRAY, 1st Batt. Gordon Highlanders, Aldershot. Gale and Polden. Price 2s.

— *Fire Discipline: its Foundation and Application.* By Lieutenant STEWART MURRAY, 1st Batt. Gordon Highlanders, Aldershot. Gale and Polden. Price 2s.

We welcome these two little works as the promising first fruits of the company training system. Lieutenant Murray, being confronted with a certain share in the responsibility for the drill efficiency of his company, evidently concluded that he could not teach what he did not know, and set to work in a practical way to supply the deficiency. He spent his leave in Germany, mixing with the regimental officers, and acquired from them a clear idea of their practice in the domain of regimental tactics; from his books and by exerting his brain he reasoned out an intelligent theory of discipline, the justification of the doctrine of "smartness," and in these little volumes he gives us the pith of his conclusions.

It was high time that the work should be taken in hand, for, as a consequence, partly of the pressure of external opinion, partly from a misapprehension of the true nature of the phenomena witnessed on the battlefields of France, the idea has been very widely spread throughout the Service, particularly amongst the auxiliary forces, that smartness on parade and all it implies is opposed to true practical efficiency in the field, and that insistence on the punctilious execution of drills and manœuvres indicates a little mind and a bullying temperament.

By physiological reasoning Lieutenant Murray proves these ideas to be untenable, and places "drill" once more before us in its true position, viz., as a means towards making the individual man braver than he normally would be. In the average man courage is almost entirely a question of greater or less self-control, and the object of *drill* in which every motion is carried out with the utmost exertion of mind and body is, by repeated exercise, to give to the brain more complete command over the muscles than it could otherwise acquire.

Our ancestors, to whom we owe the tradition of smartness, had arrived at this conclusion by dint of almost ceaseless experience in the field. They knew that under the then existing conditions the smarter and better drilled the troops the heavier the punishment they would stand without either retreating or disbanding. In the short time at their disposal during the winter months it was impossible to overdo the rigidity exacted, and the bullets of the next campaign soon restored the requisite degree of elasticity to their line formation.

It was different when the conditions altered and peace became the normal, and war the abnormal, state in a soldier's life. Then the rigidity ruthlessly insisted on defeated its own object by rendering the troops incapable of adapting themselves to the conditions presented to them by the ground and the enemy. We have no space to pursue the subject here; it will suffice to point out that the lesson the German company officers learnt on the fields of France was that the individual education of the soldier is the foundation of efficiency, and that this individual education must be principally a combined mental-bodily training, designed to render the man brave by developing to the utmost the control of the brain over the body. This is the main point that Stewart Murray's little books teach, and we can cordially recommend their study to our readers.

The Points of the Horse. By Captain HORACE HAYES. W. Thacker & Co., 87, Newgate Street, London.

The author of this work is well known in the Service as an authority on horse-matters. He has utilized his experience of many countries and his powers of observation in the production of a work dealing with the make and shape of horses.

It must be confessed that the subject of make and shape is a well worn one, and that the field for original observation in this direction is distinctly limited. Captain Hayes' manual is not remarkable for its originality, and no complaint could well be made on this account if it were not for a statement in the author's preface, which led us at first to believe that some new facts had been discovered by him which would simplify, if not revolutionise, the whole art of horse judging! It appears that Captain Hayes, according to his own account, wrote on the subject of "Shape and Make" when he knew nothing about it; the MS. was sent to the printers and lost before it reached them. While plunged in very natural grief at the loss of some years' labour, the author accidentally came across a copy of Marey's "Animal Mechanics," a perusal of which threw such a flood of light on the subject then in his mind that he rejoiced at the loss of the old and inaccurate MS., and determined to take up the subject from his new standpoint.

We venture to believe that the author undervalued his original MS., for there is no indication in its successor of anything not previously known, nor is Marey's development hypothesis (which would appear to be the chief source of the author's enlightenment), viz., the harmony existing between the organ and the function of the organ, required to explain the difference in structure between a cart-horse and a thoroughbred.

We cannot recognise Captain Hayes' claim to any original work in horse judging, but we do recognise and appreciate a book which is clearly written, accurate, well

printed, copiously illustrated, and produced by a man who has more than a passing knowledge of horses.

Almanack für die K. U. K. Kriegs-Marine, 1894. Published with the permission of the Marine Section of the Imperial Ministry for War, by the Hydrographical Department at the Imperial Dockyard at Pola, and under the supervision of the Editor of the "Mittheilungen aus dem Gebiete des Seewesens." 14th year of the new edition. Pola and Vienna: Gerold. 4 mks.

We last year had the pleasure of calling attention to the merits of this little work, and the new edition fully maintains the high standard of excellence attained in earlier issues. It is, undoubtedly, the most valuable manual of its kind published in any country, and it is astonishing that so much useful matter can be compressed into so small a compass as is the case in the work before us. The opening chapter contains the postal regulations and tariffs, and telegraphic rates for all parts of the world. Then follow the tables of weights and measures used in all countries, several pages being devoted to the reduction of the metric system to English weights and measures, including the equivalent of metre-kilogrammes and metre-tons in English foot-pounds and foot-tons, and *vice versa*. The next portion of the book is devoted to a full description of all the guns in use in different countries, dimensions, system, and where constructed, ballistic data, nature of powders employed, the different projectiles, initial velocities, &c., and the different mountings are all carefully tabulated, separate tables being given of the new Q.F. guns. The most complete and accurate list to be found in any publication is given next of the war-ships of every country, including torpedo-boats, school, gunnery, and training-ships, troop-ships, yachts, and even tugs and vessels for dockyard service, as well as all merchant steamers retained as auxiliary cruisers; there are no less than 150 wood-cuts, the profile and deck plans of the principal armoured battle-ships and cruisers of different nations, on which are shown the disposition and thickness of the armour on belts, batteries, turrets, and armoured decks, as well as the position of the different guns, their calibre and arcs of training, &c. Although these diagrams are on a much smaller scale than those given in Brassey's "Annual," yet, owing to the full details shown on them, they are incomparably superior, and the same may be said with regard to the list of the ships, which are carefully tabulated according to their different classes, with their dimensions, horse-power, estimated speed, coal stowage, thickness and disposition of armour, &c., with description of their guns, whether Armstrong, Krupp, Canet, &c., and in addition ample accompanying notes record any special information attaching to any ship, such as a belt of cellulose, the sponsoning out of guns, and other details. The latter part of the work gives the pay in all branches of the Austrian Navy, and the different regulations relating to leave, pensions, and entry of officers, concluding with a list of all the officers on the active and reserve lists of the Imperial fleet. There are 424 pages of matter in the book, which is at the same time of so convenient a size that it can be comfortably carried in a breast-pocket, while the print is clear and of a perfectly readable type. It only costs four shillings, and although in German, yet it is well worth the while of naval officers who are ignorant of that language to procure it, as the diagrams of the ships are quite worth the money alone, and require no explanation, the thickness of armour-plating being given in millimetres and the calibre of the guns in centimetres. If an English edition could be brought out at anything like the original price it would, undoubtedly, command a great sale.—H. G.

Théorie du Navire. Par J. POLLARD and A. DUDEBOUT, Ingénieurs de la Marine, Professeurs à l'École du Génie Maritime. Librairie Gauthier-Villars et Fils, 55, Quai des Grands-Augustins, Paris.

The "Théorie du Navire" is published in four thick octavo volumes, and an examination of the index of the matters treated of in them will afford sufficient evidence of the care and minute attention to detail with which every branch of this important subject has been treated. The authors were specially qualified for

the task, which they have so ably carried out, in virtue of their professional position, and they have undoubtedly rendered great service to all interested in the science of naval construction and engineering. Almost every European authority of any note in the various departments of the subject has been quoted, and apart from the original matter which it contains the book will be found to be a most useful work of reference from the fact that it is a complete compendium of all that has yet appeared on naval architecture, and its kindred subjects, which is worthy of notice.—J. J. H.

Hints to Travellers—Scientific and General. Edited for the Council of the Royal Geographical Society by DOUGLAS W. FRESHFIELD and Captain W. I. WHARTON, R.N., F.R.S., Hydrographer to the Admiralty. London, 1893: to be obtained at Stanford's, Cockspur Street. Price 8s.

The seventh edition of this useful handbook is now issued corrected up to date. The names of the contributors in the strictly scientific portions, Captain Abney, Mr. Donkin, Mr. Coles (late R.N.), Mr. Blandford, &c., are sufficient guarantees for the excellence of this portion of the work. The hints to travellers and on general outfit seem to one who has graduated in the school of the 80-lb. Cabul scale luxurious and scarcely original. The chief need of the traveller in all climates is a comfortable bed, but we have searched in vain for any description of such an article; next in importance comes reduction of weight, and a traveller who should start in 1894, or even 1893, without aluminium cooking gear, &c., would, or ought to be considered greatly behind the times. No adequate mention of the sustaining properties of kola or coca preparations for both men and animals, particularly in thirst-parched countries, is also a defect, and no notice of pack-saddles, their construction, and the different types available, comes under the same category. All this information is now almost common knowledge, and most Indian subalterns with ten years' service could supply it, at any rate the latter portion.

Taktische Unterrichts-Briefe GRIEPENKERL. Zur Vorbereitung für das Kriegsakademie Examen. Mittler.

The following notes, communicated by Captain Gawne on this work, will, it is hoped, prove useful to officers studying for examination. That the book has already run through four editions in Germany within a few years is evidence enough of the estimation in which it is held. Captain Gawne's introductory notes possess an independent value of their own quite apart from the particular work to which they are attached, and equally applicable to any similar course of study.—EDITOR.

Solution of Tactical Problems.—The following method is recommended in the solution of applied tactics or tactical problems by Griepenkerl:—

1. Carefully and repeatedly read over your orders, with the necessary map spread out before you. The longer the orders the more necessary it is to concentrate the attention.

2. Using the map, carefully study the country in question, paying especial notice to the roads. To be merely able to read a map is insufficient for any tactical scheme, and still less so for the solution of applied tactics. You should be able to create in your imagination a landscape of the country in question, *i.e.*, placing yourself in imagination on such and such a height, say to yourself: According to the map what should I be able to see from here? What villages, what roads, and how much of each road and village? Where do woods, villages, heights, hedgerows hide ground from me? The evolution of this power requires both trouble and training. The less the detail contained in a map of course the greater the skill required in making the most of it.

3. Form an exact appreciation of both your own and the enemy's positions. Imagine yourself in each of them in turn as the commander surrounded by his staff, also both the positions of your own and the enemy's troops. The freer rein you give your imagination the better will be your tactics.

4. Read through those sections of the tactical text books and drill manuals which are touched by the problem. This will certainly make you take a little more

time over your work, but time so spent will be amply repaid. When in doubt over any point carefully re-read everything affecting it.

5. *In movements calculate by measurement the time necessary to reach important points*, for not only your own troops, but also for those of the enemy. In positions measure both the breadth and depth.

6. Consider the probable counter-movements of the enemy while you are either on the march or deploying for battle. It is a common mistake for a young officer to take for granted the enemy will be inert while he moves.

7. Have a definite plan of action. Great stress is always laid on this point by the authorities as showing your strength of will. Whatever you do, keep clear of half measures. If, for instance, you resolve on an attack, throw your entire strength into it—all your troops. If, on the other hand, you determine on a retreat, you must not, on the most trivial excuse, halt before you have gone a mile. *Make up your mind clearly before acting, and show decision in carrying your ideas into effect.*

8. *Distribution of troops, Consideration as to.*—First write your orders out in the rough, and then see if you have disposed of all the troops allotted to you. A beginner often forgets some troops. According to my experience such a mistake most generally happens in the distribution of the cavalry.

9. Now it is time to draw up the actual orders. Use forms till you are certain of forgetting nothing. Write out the orders also in the rough, then scan them carefully paragraph by paragraph to see whether they fulfil the following requirements:—

Each order should be in its logical sequence. The following forms will give you this till you have acquired the necessary skill. Be careful to number your paragraphs, and group all passages relating to the same subject in the same paragraph.

Orders should be as brief as possible. Short sentences are easier to understand; prolix and long-winded artificial sentences are unmilitary. Test your orders, therefore, to see if some word is not superfluous—if some sentence could not be given a shorter turn. In short, grudge every word. This will at first cause much alteration in the rough copy, which is as it should be. An old saying has it—“Orders in which much has not been altered in the rough are worth nothing.” Prolix orders are apt to lead to the adjutants who are copying or taking them down from dictation precisising them on their own account, and so causing mistakes. Orders must be so worded that abbreviation on the part of the person copying them is impossible.

All orders should be absolutely clear. The writer should put himself in the place of the recipient; this will often cause the change of an expression, and so avoid the possibility of misunderstanding. With this idea, such expressions as “right,” “left,” “before,” “behind,” “this side,” or “that side,” are to be avoided, and the compass-bearing substituted.

Orders should be most precise. Undecided orders will not be put into force with any heart. Reject all such dubious expressions as “if possible,” “when practicable,” “under circumstances,” &c. *You are responsible for your orders, and must not throw any of this responsibility on the shoulders of your subordinate.* A precise order gives this latter decision in the execution of his work. The more difficult the task, the clearer and more precise should be the orders.

Orders should never dictate arrangements which interfere with the subordinate's authority. This fault is not only often committed in the field, but also in paper exercises. Your order assigns the subordinate his task—*how he executes it is his business.* On actual service there will still always be time to interfere if you find your intentions being misconstrued.

Orders should not forecast too much, otherwise you will often have to recall them, and then *ordre, contre-ordre, désordre!* Frequent change in orders destroys the confidence of the troops and exhausts them; the subordinate leaders also become uncertain in their bearing. “Expectations” and “surmises” are out of place in orders. If they do not come off, the leader's mistake is recognised, and the troops lose confidence in him.

Orders should always name time and places so distinctly as to preclude the possibility of mistake. Never omit to add P.M. or A.M. to the hour and minute.

For further information turn to the Field Exercises 1/39 to 49. Do remember that these paragraphs are the outcome of much war experience, and are not petty minutiae. If their teaching is neglected, the consequences may easily be irremediable.

Having now carefully worked out both distribution of troops and your orders in the rough, transcribe them out in a very clear hand,¹ the clearer the better. It is recommended to underline the first words of each paragraph.² Such clear writing requires much practice if it is not to be lost in the flurry and more or less excitement of the examination. Good orders ought, so to say, to be grasped at a glance. Such clear writing has also on service no small value, for each person can then quickly see what concerns him, and also the order will be much more quickly and readily understood.

FIRST EXERCISE.

A detachment under Colonel A., consisting of 98th Regiment, 1 and 2 sq. 9th Dragons, 31st Batt. F.A., 1 comp. 16th Pioneers, and a section A.H. Corps, having its safety secured by other troops, has bivouacked on the 23rd July, 1889, south of Liéhon, and receives on the 2nd July, at 9.30 P.M., the order to interrupt next morning the railway at the station of Peltre for several days. Hostile cavalry patrols were seen on the evening of the 2nd July south of the open town of Metz. It is certain that hostile infantry and artillery are bivouacking at Antilly.

PROBLEM.

1. Colonel A.'s orders on the evening of the 2nd July, 1889.
2. Reasons for these orders.
3. Sketch showing the position of his troops an hour after leaving the bivouac.

The form for orders follows. No other assistance is given purposely, as you will thereby learn to work more thoroughly and quickly. Do not waste too much time over the sketch. The chief object being to see if you are thoroughly acquainted with the rates of march of each arm and their road spaces.

In working, have the tactical text books and the various regulations at your side. Nothing else. Accustom yourself to work by the watch, that is, from the moment you sit down to work till the last stroke of the pen. *Make it a principle to commence and finish your work at a sitting.*

MARCH ORDERS.

Detachment Orders.

<i>Distribution of Troops.</i>	<i>Place. Time. Date.</i>
1. Independent cavalry. Leader. Cavalry.	1. <i>Information regarding the enemy and your own army.</i>
2. Advanced guard. Leader. Infantry. Cavalry. Artillery. Engineers. A.H. corps (seldom).	2. <i>Work assigned to the detachment. (Your general intentions.)</i>
	3. <i>Orders for independent cavalry. (Time of march, rendezvous, roads to be used, reconnaissance if necessary, special work.)</i> ³

¹ With this intention German staff officers are taught a stereotyped large, round hand.

² Another characteristic of the German Staff is placing the *motif* of the paragraph in a few underlined words at the commencement. The most marked instance of this is to be found in the *Field Service Manual*.

³ If the cavalry is attached to the A.G., the distribution of troops must be accordingly altered, No. 3 order omitted, and No. 4 modified to suit case. If there are outposts, there should be an order regarding them.

MARCH ORDERS—continued.

*Detachment Orders.**Distribution of Troops.*

3. Main body (and order of march).
N.B. No leader.
Cavalry (orderlies or sections).
Infantry.
Artillery.
Infantry.
Engineers.
A.H. corps.

4. Right (left) flank guard similar to advanced guard.

Method observed in issue of these orders.

Place. Time. Date.

4. *Orders for advanced guard.* (Time of march, rendezvous, necessary reconnaissance, route to be followed, special orders.)
5. *Orders for the main body.* (Either interval from A.G. or time of march and rendezvous.)
6. *Orders for flanking detachments.* Similar to 4, but generally mostly referring to reconnaissance, according to circumstances
7. *Orders for baggage.* (Leader, distance from main body, and special instructions.)

Position of leader at commencement of movements.

Signature.

SOLUTION.

Bivouac S. of Z. Liéhon. 11, v, 89.
11.15 P.M.

*Detachment Orders.**Distribution of Troops.*

1. Independent cavalry.
Captains.
1st squadron (minus a section) and 2nd squadron 9th Dragoons.
2. Advanced guard, Lt.-Col. B.
1/98th Regiment.
1 section, 1 squadron 9th Dragoons.
1 company of 16th Pioneers.
3. Main body (and order of march).
A sergeant and 6 men of 1st squadron 9th Dragoons.
2/98th Regiment.
7th battery 31st Field Artillery Regiment.
3/98th Regiment.
Section A.H. corps.

1. *Hostile infantry and artillery* bivouacked at Antilly, and cavalry patrols south of Metz are reported.
2. *The detachment* marches to-morrow morning on Mercy-bei-Metz.
3. *The independent cavalry* will advance to-morrow, at 5 A.M., on Mercy-bei-Metz, reconnoitring to Colombey, Borny, Quélien, and Sablon. Particular attention is directed to the Hospitalwald and the great forest of Champel.
4. *The advanced guard* also advances at the same hour by the main road, *via* Grève-la-Haute, on Mercy-bei-Metz.
5. *The main body* follows at 800 yds. interval.

*Detachment Orders—continued.**Distribution of Troops.*

Dictated to officers or N.C.O's. of the various corps.]

6. *The heavy baggage*, for whose escort and direction the 1st squadron 9th Dragoons will give an officer and a few men, remains on the road leading from Liéhon to the main road.

7. Reports will find me at the head of the main body.

A. Col.

Standards and Colours of the Army. By S. M. MILNE, late Major 3rd W.Y.B.V. Leeds: Goodall and Suddick. Only 200 printed.

Mr. Milne has devoted many years to the careful study of the successive changes in the uniforms, standards and colours, and badges of the British Army, and he is widely recognised as the best authority on the subject of this book. Much valuable information has been imparted by his contributions to the records of regiments, and in other forms, and he has largely increased our obligations to him by this his latest work. In the arrangements of the various parts of his subject several modes were open to him. Of these he has adopted that which seems the most reasonable and convenient; for, as the headings of the chapters show, the contents are generally presented in chronological sequence, but where a rigid adherence to this order would be evidently inconvenient he classifies his descriptions differently.

The first chapter tells us what is known about the standards and colours used during the Civil War, and the next continues the account till the death of Charles II. This strict chronological order is maintained till we come to the eighth chapter, which treats of infantry colours only; and in several succeeding chapters cavalry and infantry are, for convenience, treated separately. The small space available precludes any notice of many interesting topics and incidents, and only a few can be mentioned. And here it may be observed that the author, following most authorities, tells us that the Admiral's regiment was incorporated in the Coldstream Guards in 1689. But Major Edye has shown, from authentic documents, in the first volume of his "*History of the Royal Marine Forces*," that the Admiral's regiment was disbanded, officially, on the 28th February, 1689, and actually, soon after that date. We are informed, on p. 102, that the name of "*Emsdorf*," borne by Elliott's Light Horse (now 15th Hussars), was the first name of an action ever granted to a British regiment. In writing of the removal of many heraldic devices and the substitution of plain numbers in 1751, Mr. Milne says, "In their place boldly and resolutely stands the regimental number, simple in form, easily recognised, easily remembered, forming a rallying point in the minds of soldiers, which, as decade after decade passed away, became indissolubly connected with some glorious deed, in its turn becoming a matter of history, adding lustre to the regimental number; and so, gradually but surely, building up that wonderful regimental *esprit de corps* which has stood the nation in good stead on so many occasions."

The book bears evidence of care on every page, yet it is not quite free from those clerical and typographical errors which seem unavoidable in a first edition. The appendices are very useful for reference—more useful than an index in the usual form. The numerous and admirable illustrations, of which 126 are coloured, are remarkable for clearness and accuracy.

Most of his readers will appreciate the motives which induced Mr. Milne to terminate his labours with the date of the changes inaugurated in 1881—changes by which the history and traditions of famous regiments were broken and confounded, and will sympathise with him in lamenting those changes, as he does in the following concluding paragraph:—

"The effect of mixing, or blending, the battle honours and devices of two different regiments severed the continuity of the regimental colour, and also that of the regimental history itself. Henceforth a new army, with new traditions, has to be created. Already, much detailed in these pages is becoming a matter of ancient history; therefore it is befitting to bring this work to a conclusion with the year 1881, and take leave of the colours whilst they yet exhibit, to their full extent, the result of two centuries of regimental existence."—O'C.

Korea and the Sacred White Mountain, being a brief account of a Journey in Korea in 1891. By Captain A. E. J. CAVENDISH, F.R.G.S., 1st Argyll-Sutherland Highlanders. Together with an Account of the Ascent of the White Mountains. By Captain H. E. GOULD-ADAMS, R.A. London: George Philip and Son. Price 25s.

Since, from inquiries at the Intelligence Department, it appears that only two British officers have ever penetrated into the recesses of this out of the way corner of the globe, and that these two officers are the joint authors of the book before us, it is impossible to criticise it on the grounds of accuracy or precision. We can only welcome it as a sign of the roving disposition of the coming generation, their earnest desire to make the most of the opportunities their leave season allows them, and can cordially recommend their work to all who may be interested in this little known corner of the globe.

Gunner Jingoe's Jubilee. London: Remington. 1893. Price 10s. 6d.

What possessed the author to wilfully damn his own work by such a title it is impossible to discover—for one reader attracted by it, fully 49 must have been repelled; but the 49 are the losers, for the title covers the life history of a man who has much to tell us, and, on the whole, does so in clear, readable style. His experiences in the Mutiny will attract most attention, and will form valuable evidence, in competent hands, for future histories of that era. We specially commend it to the study of young officers who have not yet undergone the ordeal by fire. In it they will find the corrective to be applied to purely theoretical study. All strategical and tactical principles ultimately depend for their soundness on the conduct of human beings under circumstances of imminent danger—a point too often neglected; and since nowadays a few months with the armies in the Netherlands perforce no longer form a part of the educational curriculum of a gentleman, nothing but the study of the works of those who have had the experience which the young officer necessarily lacks is left him, and, to our mind, will bring far more substantial profit than hours spent in the perusal of theoretical works which treat the soldier as an inanimate pawn, and of war as a glorified game of chess.

Geschichte der Festungen Danzig und Weichselmünde bis zum Jahre 1814. By G. KÖHLER, Major-General 3 D. 2 vols. Breslau: 1893. Koebner. Price 40s.

General Köhler is one of the first of living authorities on all that relates to the evolution of the attack and defence of fortresses. As Danzig has formed the focus of warlike operations, and been besieged at least half-a-dozen times in each century since the fourteenth, General Köhler's history forms a running comment on the practice of attack and defence in successive eras of the greatest interest to engineers and artillerymen.

Kriegs Geschichtliche Eingelsschriften. No. 16. *Pirmasens und Kaiserslautern.* Issued by the German General Staff. Mittler, Berlin. Price 3s.

Little is known of this campaign in England, but, as the last victorious appearance of the Prussian line tactics opposed to the revolutionary skirmishers and small column system, it deserves special attention.

La Guerre au Dahomey. 1888-93. Compiled from official sources. Ed. AUBLET, Captain Marine Infantry, Adjutant to the Minister of Marine. With 21 sketches and 2 maps. Paris: Berger, Levrault, & Co. Price 7s. 6d.

Leitfaden für den Unterricht in der Heeres Organisation auf den Königlichen Kriegsschulen. Published by permission of the Inspector-General of Military Education in Prussia. Berlin: Mittler. Price 1s. 6d.

Das Militair Strafverfahren in Russland-Frankreich und Deutschland. Dr. ERNST FRANZ WEISL, Judge-Advocate. Vienna. Vienna Reichswehr. Price 4s.

Traité d'Équitation illustré. Par le Comte D'AURE. 5th edition. Paris: Baudoin. Price 10s.

The Count was chief equerry to Louis XVIII, Charles X, Napoleon III, and subsequently chief of the cavalry school at Saumur. The book is illustrated, and gives a summary of all progress in equitation from the 16th century down to the present day.

Discovery of Lakes Rudolff and Stefanie. A narrative of Count Samuel Teleki's Exploring and Hunting Expedition in Eastern Equatorial Africa in 1887-1888. By his companion, Lieutenant von HÖHNEL. London: Longmans, Green, & Co., 1894.

Glimpses of the French Revolution. By JOHN G. ALGER. London: Sampson and Low. 1894.

Wer Wird Siegen. By A. STEIN. Berlin: Mittler.

In a short pamphlet the author discusses the prospects of Germany in her chronic struggle with the Slav race. Much useful information is given as to the existing condition of the Baltic provinces, where the German landowner is undergoing the same process as the Irish landlord with us.

Des Opérations Maritimes contre les Côtes et des Débarquements. By General BORGNI-DESBORDS. Paris: Berger Levrault. Price 2 fr. 50 c.

Histoire Diplomatique de l'Alliance Franco-Russe, 1873-1893. Ernest DAUDET. Paris: Ollendorff. Price 7 fr. 50 c.

Tactique et Stratégie. Mouvements de Flanc. Par le Général BERNARD. Par's: Baudoin. Price 5 fr.

Le Régiment de Réserve et la Loi des Cadres. By General SEWAL. Baudoin. Paris: Price 2 fr. 50 c.

Die Kommenden Feldgeschütze. Von WILLE, Major-General. Berlin: Eisen-schmidt.

Von Wille's previous works on the field gun of the future attracted universal attention, and a *précis* of the book was published in this journal. The author's views encountered much criticism, both in his own country and elsewhere. This, the latest edition, contains his replies.

Geschichte des Anhaltischen Infanterie Regiment No. 93. Von RÜSTER (Hauptmann). Berlin: Mittler. 1st part. Price 8 mks.

The history of this regiment, trained by the "Old Dessauer" himself, should be of unusual interest.

Gas, Oil, and Air Engines. By BRYAN DONKIN, M.I.C.E. London: Griffin and Co. Price 21s.

Specially recommended to officers interested in the solution of the liquid fuel problem. The book brings the subject of the manufacture and production of the different oils up to date.

Aide-Mémoire de l'Officier de Marine, for 1894. Pocket edition. 1894. Price 5 fr. To be obtained through Dulau, Soho Square, London.

Organisation des Colonies Françaises et des Pays de Protectorat. Par ÉDOUARD PETIT, Chef de Bureau à l'Administration Centrale des Colonies. 2 vols. 12 fr. each. Paris: Berger Levrault, 5, Rue des Beaux Arts.

Essai de Stratégie Navale. Par le Commandant Z——— et H. MONTÉCHANT. 1 vol. 550 pages, with plates. Paris: Berger Levrault. Price 10 fr.

La Vie Militaire au Tonkin. By Captain LECOMTE, on the Staff of the Expeditionary Force. 360 pages, with 70 illustrations, maps, &c. Paris: Berger Levrault. Price, sewn, 10 fr.; bound, 12 fr. 50 c.

Le Général Eblé. 1758-1812. By Captain MAURICE GIROD DE L'AIN, French Artillery. Paris: Berger Levrault. Price 4 fr.

To be obtained through Messrs. Stanford, Cockspur-street:—

Fergusson's History of Architecture, Ancient and Mediæval. 2 vols. Price 63s. January, 1894.

Economic Geology of the United States. February, 1894. Price 16s.

Social Evolution. BENJ. KIDD. February, 1894. Price 10s. An antidote to Pearson's "National Life and Character."

Big Game Shooting. Badminton Library. 2 vols. Price 21s.

Life of Sir Harry Parkes. DICKINS. 2 vols. 25s.

The Partridge. "Fur and Feather" series. By A. STUART WORTLEY and others. Price 5s.

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